Energy efficient housing in South Africa

Overview of current state of affairs

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Contents

Contents ... 2
List of figures ... 4
List of tables ... 5
Introduction ... 6
1. Low-cost subsidy housing in South Africa ... 7
1.1. RDP subsidy ... 7
1.2. The need for housing ... 9
1.3. Houses delivered ... 9
1.4. Houses to be built ... 11
1.5. Flow of housing subsidies ... 12
1.6. Role and functions of provincial government and municipalities ... 12
1.6.1. Provincial government ... 12
1.6.2. Municipalities ... 13
1.7. Government sponsored institutions ... 13
1.7.1. National Urban Reconstruction and Housing Agency (NURCHA) ... 14
1.7.2. National Home Builders Registration Council (NHBRC) ... 14
1.7.3. National Housing Finance Corporation (NHFC) ... 14
1.7.4. Social Housing Foundation (SHF) ... 14
1.7.5. The Rural Housing Loan Fund (RHLF) ... 14
1.7.6. Servcon Housing Solutions ... 14
1.7.7. Thubelisha ... 15
1.7.8. Peoples' Housing Partnership Trust (PHPT) ... 15
2. Principles of energy efficiency in housing ... 16
2.1. Passive thermal design ... 16
2.1.1. Orientation of houses ... 16
2.1.2. Building materials ... 17
2.1.3. Daylighting ... 17
2.1.4. Roof overhang ... 17
2.2. Weatherisation and ventilation ... 18
2.3. Ceilings ... 18
2.4. Wall insulation ... 19
2.5. Flooring ... 19
2.6. Shared walls ... 19
3. Experience with energy efficient housing in South Africa ... 21
3.1. All Africa Games Village, Alexandra ... 21
3.2. Krugersdorp Housing project ... 22
3.3. Kutlwanong Eco-housing project ... 22
3.4. Ivory Park insulated ceiling demonstration project and mud brick house ... 23
3.5. eMbalenhle air pollution reduction project ... 24
3.6. Mohlakeng, Ext. 2, Randfontein ... 24
3.7. Thermally improved shacks, Mabopane ... 24
3.8. SEED housing Cape Town ... 24
3.9. Tlholego ... 24
3.10. Alexandra East Bank Housing Development ... 25
3.11. Marconi Beam Trust Demonstration Village ... 25
3.12. SOWETO eco home ... 25
3.13. Shayamoya - Cato Manor, Durban ... 26
3.14. Missionvale, Port Elizabeth ... 26
3.15. Waterloo Development Project ... 26
3.16. Hull Street development / Moshoeshoe eco-village ... 26
3.17. Dutch AIJ (Benoni, Kimberley, Cape Town, Lady Grey) ... 27
3.18. Low-cost urban housing upgrade, Khayelitsha, Cape Town ... 28
3.19. Rural hamlets in Stellenbosch ... 29
3.20. Clean SOWETO Air Fund ... 29
4. Green financing ... 31
4.1. Department of Housing - Green Housing Finance Initiative ... 31
4.2. Development Action Group (DAG) ... 31
4.3. Commercial banks' initiaves ... 31
5. The role of bi-lateral aid agencies ... 32

5.1. DANIDA 32
5.2. DGIS 32
5.3. USAID 32
5.4. AUSAID 32
5.5. DFID 32
5.6. SIDA 33
5.7. GTZ Germany 33
6. The role of NGOs 34
6.1. International Institute for Energy Conservation (IIEC) 34
6.2. The Social Housing Focus Trust (SHiFT) 34
6.3. Sustainable Energy Africa (SEA) 34
6.4. Efficient Lighting Initiative Bonesa 35
6.5. Greenhouse project 35
6.6. Sustainable Energy, Environment and Economic Development (SEED) 35
6.7. Trees for Homes programme 35
6.8. Urban Sector Network (USN) 35
7. Energy savings potential 36
7.1. Current energy use for space heating 36
7.2. Possible interventions and their associated savings 37
7.2.1. Baseline 37
7.2.2. Interventions 38
7.2.3. Heating requirements simulations 39
7.2.4. Assumptions 39
7.2.5. Simulation results 39
8. Barriers for the mainstreaming of energy efficient low cost housing 41
9. Conclusions 42
Literature 43
Appendix 1: persons met 45

List of figures

Figure 1 & 2 The current design of RDP houses is very energy inefficient.................... 7
Figure 3 Top structures completed between April 1994 and March 2001 10
Figure 4 Historic trends in housing delivery.................... 10
Figure 5 Total RDP housing delivery till 2005 11
Figure 6 Flow of subsidy funds.................... 12
Figure 7 Passive solar design will reduce the energy use.................... 16
Figure 8 Roof overhang to prevent overheating in summer without sacrificing solar benefit in winter 18
Figure 9 Air gaps between the door and doorpost lead to excessive heat losses 18
Figure 10 Innovative ceiling products can reduce the investment by 50%.. 19
Figure 11 RDP houses sharing walls to save on construction costs and energy consumption. 20
Figure 12 & 13 Midrand EcoCity mud brick house during construction 23
Figure 14 & 15 The mud brick house after completion and painting.................... 23
Figure 16 Energy efficient houses in Lady Grey.................... 27
Figure 17 & 18 Brick house with cavity wall at Benoni 27
Figure 19 & 20 Innovative new materials for energy efficient houses in Benoni.................... 28
Figure 21 Baseline 30 m^2 RDP house 38

List of tables

Table 1 Housing subsidy amounts as per 1st of April 2002 8
Table 2 The subsidy market consists of 85% of the total housing market. 8
Table 3 The national housing backlog adds up to 2.2 million households 9
Table 4 expected number of houses to be supported by RDP housing subsidy 11
Table 5 Over the next three years 711000 houses are planned to be delivered 11
Table 6 Price ranges of interventions. Source: (DoH 2000b). 16
Table 7 Emissions and costs of baseline and CDM alternative 28
Table 8 Annual consumption for space heating by region and fuel. 36
Table 9 Share of houses using fuel for space heating by province (in %) 36
Table 10 Electrical space heating 36
Table 11 Average monthly household energy consumption (in delivered MJ) 37
Table 12 Results of the 2002 energy use survey on space haeting in RDP type of houses in Gauteng and Free State 37
Table 14 Climate change emission factors: 40
Table 15 Cost of the interventions (in Rand per house) 40
Table 16 Proposed interventions 40
Table 17 Barriers towards the mainstreaming of energy efficient low-cost housing 41

Introduction

With efforts ranging from small to substantial and costs from minimal to high, interventions in the design and construction of residential houses can result in substantial reductions in the energy requirements to keep the house at comfort level.

In South Africa quite a large number of initiatives on energy efficiency in low cost housing have been initiated in the past, resulting in a substantial number of pilot and demonstration houses all over the country. However, energy efficiency has never become main streamed in the ongoing low-cost housing subsidy programme.

Currently a World Bank supported programme is under development to address this situation. Part hereof is the investigation of the current state of affairs on energy efficient housing in South Africa as described in this report.

In chapter 1 the current housing delivery programme is described, including the roles and responsibilities of the different levels of government and an overview of government sponsored institutions active in the housing delivery process. Chapter 2 gives a theoretical overview of possible interventions to reduce the energy requirements of residential houses, to be followed by an overview of all known initiatives on energy efficiency in low cost housing in the country (chapter 3).

In chapter 4 an overview is given of additional finance initiatives to supplement the housing subsidy. Whereas chapters 5 and 6 list the international donors that funded initiatives in energy efficient housing and Non-Governmental Organisations that are active in South Africa in the field of low-cost energy efficient housing respectively.

In the 7^{th} chapter the potential for energy savings is discussed and in chapter 8 a discussion on the barriers for the uptake of energy efficiency follows.

The report is completed with the conclusions and literature references.

The writing of this report wouldn't been possible with the support of a large number of persons I met over the course of this exercise. An overview can be found in Appendix 1: persons met. Thank you very much to all of you!

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This report is of a draft nature and needs to be seen as a living document. It will be revised based on more accurate data and feedback by parties involved. Therefore your feedback is highly appreciated and explicitly solicited for.
The latest version of this report can be downloaded from
http://microhydropower.net/klunne/rsa_eeh.html

1. Low-cost subsidy housing in South Africa

In the seven years from April 1994 to the end of the fiscal year 2000/2001 (March 31, 2001), nearly 1.2 million houses financed under the Reconstruction and Development Programme (RDP) have been constructed or were under construction. During this period the subsidy amount has not been increased to keep peace with the rate of inflation. What could be built for the maximum subsidy amount of 16.000 Rands in 1994/5 can not be easily achieved today. Working within the Minimum Norms and Standard regulations, municipalities and developers have had to find innovative ways to deliver conventional houses on serviced sites to match the unit size and levels of service required by these regulations.

Despite the fact that the Minimum Norms and Standards include energy- and water-efficiency, it is recognised that the majority of new housing projects do not give consideration to these and other environmental sound practices. In recent years numerous initiative have been launched with the objective of promoting environmentally considerations concerning both the houses and its serviced site. An overview of these projects can be found in chapter 3 of this report.

Figure 1 & 2 The current design of RDP houses is very energy inefficient

1.1. RDP subsidy

South Africa's housing capital subsidy scheme was introduced in the 1994 White Paper for all households with a monthly income of less than R 3500, who have not owned property previously, and who satisfy a range of other criteria. The overall objective of the housing subsidy has been to assist households to access affordable housing of a good standard, with secure tenure. There are six subsidy mechanisms: individual, project-linked, consolidation, institutional, rural, and relocation:

- Project-linked, individual and rural subsidies of between R 5500 to R 16 000, are available to households seeking ownership tenure. Rural subsidies are provided to households who hold informal land rights in respect to state land.
- The Relocation subsidy is offered to borrowers who, on 31 August 1997, were at least three months in arrears, and who are now prepared to relocate to more affordable housing.
- The consolidation subsidy provides a "top-up" amount of R 8 000 to households who have already received a smaller subsidy under a previous scheme.
- The institutional subsidy provides a R 16 000 subsidy to an institution that provides housing for rent, rent-to-buy, instalment sale, co-operative ownership, or other forms of secure tenure, for each subsidy-eligible household that lives in the institution's housing stock.

Housing may be delivered either by developers or by the beneficiaries themselves in terms of the "Peoples' Housing Process". This latter approach has become a favoured option of government, who wants to encourage household participation in the housing process.

As of the 1st of April 2002, the subsidy mechanism has changed fundamentally. The most significant change involves a requirement from government that households contribute a minimum of R 2 749 to be eligible to receive the subsidy. Single women with dependants, the disabled and the aged who earn less than R 800 per month are not required to make the own contribution, which the state will make on their behalf.

Households that cannot afford such a contribution most follow the Peoples' Housing Process route, providing their labour in lieu of a financial contribution, in order to be eligible to access the subsidy.

Also from the 1st of April 2002, new subsidy amounts have been introduced to account for inflation. The new amounts are as displayed in Table 1, and apply to the project-linked, individual, relocation and rural subsidy mechanisms. The institutional subsidy has also been raised, to R 27 000, on condition that it is supplemented with R 27 000 of additional finance. (DoH 2002a)

Income (R/month)	Subsidy (R)	Own contribution (R)
0 – 1500	R 20 300	R 2 479 (compulsory)
1500 – 2500	R 12 700	balance of purchase price
2500 – 3500	R 7 000	balance of purchase price

Table 1 Housing subsidy amounts as per 1st of April 2002

Theoretically the subsidy amount can be increased by an amount of 15% to compensate for abnormal development costs arising from location, geo-technical or topographical conditions. In practice most of the beneficiaries receive the extra 15%, simple because as much subsidy as possible is given.

The subsidy amount needs to be divided in 50% for land and 50% for the top structure.
Research by the NHBRC[1] revealed that the cost for a 30 m^2 RDP house will cost between R 10 000 and R 18 400 for the top structure only. From these figures it can be concluded that the available amount of subsidy per house alone is not sufficient to construct a good quality house[2].

Market segment	Household income/month	House price	Percentage population
1A. Functioning primary and secondary housing market and rental segment • Mortgage finance available • Developer and landlord-delivered stand-alone and medium-density units • Tenure: Outright ownership, freehold and sectional title, rental	Over R 7,500	Over R 150,000	5 %
1B. Functioning primary and secondary housing market and rental segment • Mortgage finance, pension and provident fund lending • Developer and landlord-delivered stand-alone and medium-density units • Tenure: Outright ownership, freehold and sectional title, rental	Between R 3,500 and R 7, 500	Between R 75,000 and R 150,000	10 %
2. Subsidy plus segment • Subsidies and own contribution, pension and provident fund lending, micro-loans, pricing for risk • Developer or institution delivered stand-alone and medium-density units • Tenure: Outright ownership, freehold • Risks: financial and credit • Supply-side blockages	Between R 1,500 and R 3, 500	Between R 30,000 and R 75,000	20 %
3. Subsidies and informal market • Subsidies and own contribution under Government program with stand-alone and medium-density units; developer delivered or self-delivered through People's Housing Process • Informal market: no subsidy, self/group-built informal structures	Below R 1,500	Below R 30,000	65 %

Table 2 The subsidy market consists of 85% of the total housing market.

[1] National Home Builders Registration Council
[2] It has never been the intention to have the RDP subsidy covering all the costs of the house.

1.2. The need for housing

The Department of Housing states in the National Housing Code of March 2000 (DoH 2000c): 'The total number of households in South Africa was estimated in 1997 at 9.05 million. The housing backlog in 1997 was estimated on 2.2 million units.' This means that at least 2.2 million families are without adequate housing, almost 25% of all the households. Because of population growth and immigration, this figure increases by about 204 000 units every year. In urban areas, it is estimated that the backlog in 1997 was 1.92 million units. In rural areas, the backlog in 1997 was estimated at 300 000 units.

This does not mean that the families are necessarily homeless, but rather that the housing conditions are unacceptable, in terms of what the government has defined in its national housing vision. The total number of households was estimated to be 10.77 million in 2000, which is more than 1.7 million more, compared to 1997 (SSA 2001). The housing backlog in 2000 was estimated on 2.8 million units, which is an increase of 0.6 million units, compared to 1997 (Winkler, Spalding-Fecher et al. 2000). The increase of the housing backlog is not as sharply upwards as the number of households, but still is upwards. The need for housing in every segment of the low-income sector and the effort to provide the houses remains. A sustained effort to reduce the backlog, in any given segment of the low-income sector, is therefore most needed.

	shacks in backyard	shacks elsewhere	total number of shacks	informal housing	total backlog number	% of total backlog	traditional dwellings	total number	% of total
Eastern Cape	31248	114203	**145451**	77949	**223400**	10.1%	547624	**771024**	20.0%
Free State	50644	112059	**162703**	41462	**204165**	9.3%	63981	**268146**	7.0%
Gauteng	153429	314839	**468268**	263420	**731688**	33.2%	13975	**745663**	19.4%
KwaZulu Natal	44333	141197	**185530**	136845	**322375**	14.6%	532342	**854717**	22.2%
Mpumalanga	24564	69871	**94435**	42023	**136458**	6.2%	108303	**244761**	6.4%
Northern Cape	4931	21286	**26217**	13484	**39701**	1.8%	7222	**46923**	1.2%
Limpopo	15631	32277	**47908**	55324	**103232**	4.7%	312169	**415401**	10.8%
North West	45085	114257	**159342**	55974	**215316**	9.8%	50428	**265744**	6.9%
Western Cape	33143	129740	**162883**	63030	**225913**	10.3%	8656	**234569**	6.1%
TOTAL	**403008**	**1049729**	**1452737**	**749511**	**2202248**	**100%**	**1644700**	**3846948**	**100%**

Table 3 The national housing backlog adds up to 2.2 million households (SSA 1999)

1.3. Houses delivered

The target for the housing delivery was set at 1 million houses by the year 2000. This number was not completely met, but a substantial number of houses were delivered. The graph gives the breakdown of these numbers over the provinces.

Nearly all of these houses are of the standard RDP design. The houses built at the start of this period might have some of the energy efficiency measures like ceilings included, but with the subsidy amount fixed at R 16 000 since 1994, houses built more recently do not have anything besides the basics. It is save to assume that 90% of this existing stock is potentially interesting for retrofitting energy efficiency interventions.

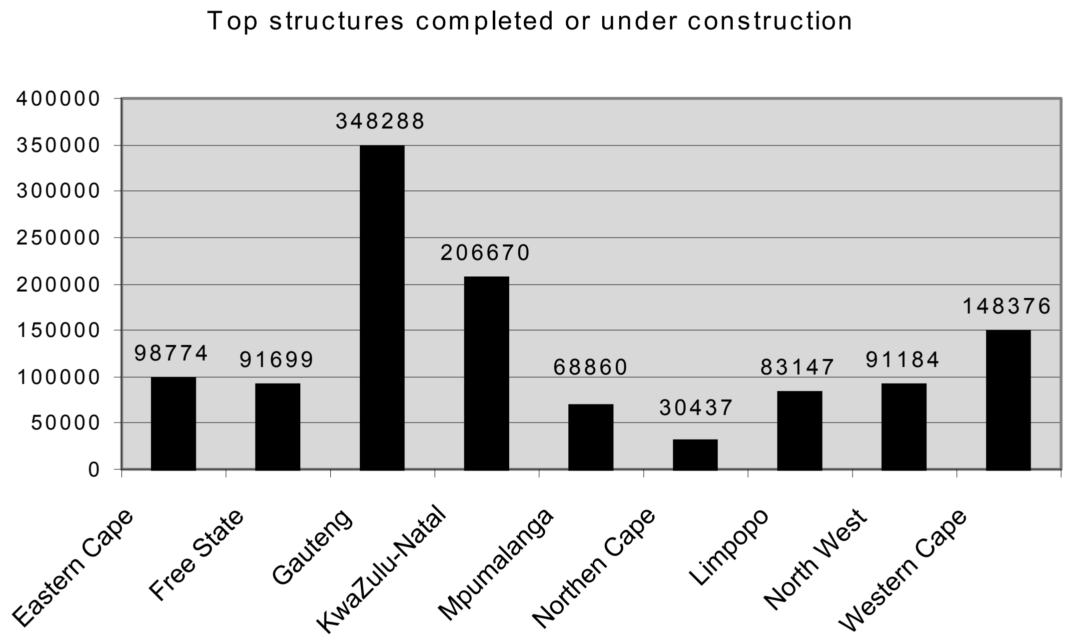

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Figure 3 Top structures completed between April 1994 and March 2001 (DoH 2001)

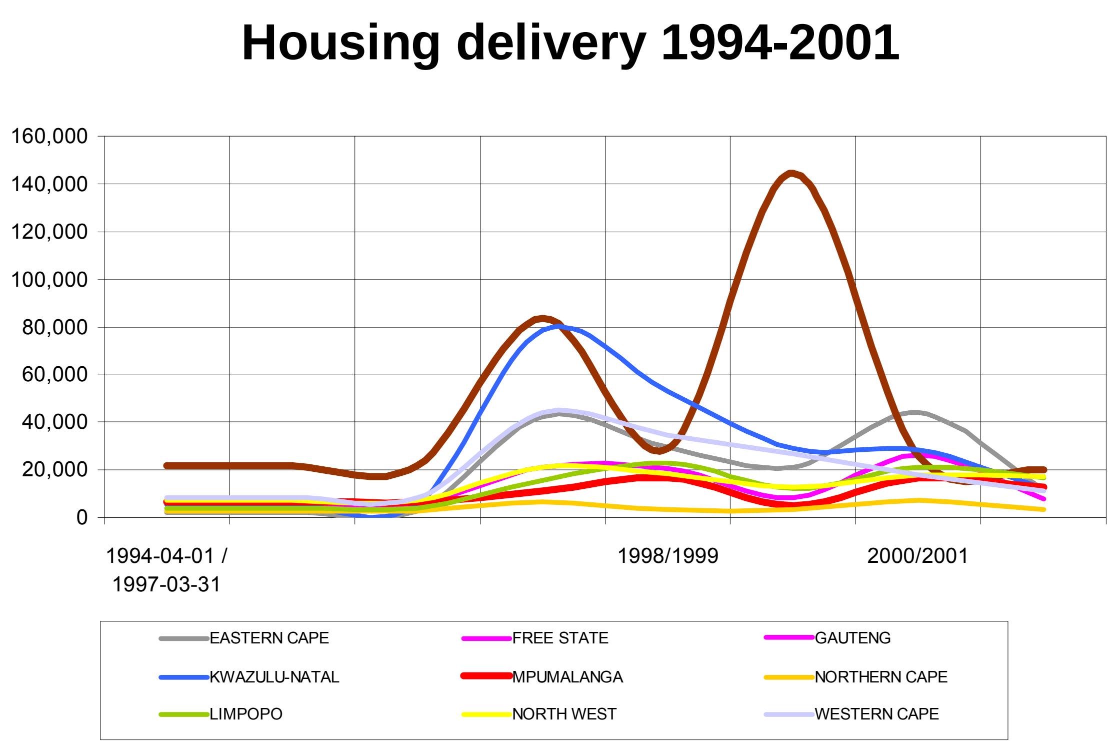

Figure 4 Historic trends in housing delivery (Development Works 2002)

1.4. Houses to be built

Until recently, the expectation was that yearly approximately 200 000 RDP-type of houses would be needed in the country to serve the annual household formation. These houses would be of the standard stand-alone low-density houses. To cater for the housing backlog, another 100 000 houses per year were envisaged.

Within South Africa the tendency is shifting from the traditional stand alone, freehold houses towards so-called medium density rental accommodation. New policy of the Department of Housing (is reflecting this shift. Table 4 shows the effect on the number of houses to be supported by DoH with the RDP subsidy.

	current subsidy housing		medium density housing	
	no of units	subsidy amount	no of units	subsidy amount
2001/2	180 000	R 16 000	-	-
2002/3	150 000	R 17 000	150 000	R 27 000
2003/4	100 000	R 18 000	200 000	R 27 000
2004/5	50 000	R 19 000	250 000	R 30 000

Table 4 expected number of houses to be supported by RDP housing subsidy (source: internal documents DoH)

	units total		developer		PHP		institutional	
Eastern Cape	120000	17%	72%	86400	22%	26400	6%	7200
Free State	45000	6%	73%	32850	12%	5400	15%	6750
Gauteng	120000	17%	50%	60000	37%	44400	13%	15600
KZN	140584	20%	72%	101220	11%	15464	17%	23899
Limpopo	61700	9%	71%	43807	13%	8021	16%	9872
Mpumalanga	51594	7%	77%	39727	15%	7739	8%	4128
Northern Cape	17094	2%	77%	13162	8%	1368	15%	2564
North West	79894	11%	83%	66312	8%	6392	9%	7190
Western Cape	75220	11%	68%	51150	14%	10531	18%	13540
Total national	**711086**	**100%**	**70%**	**494629**	**18%**	**125714**	**13%**	**90743**

Table 5 Over the next three years 711000 houses are planned to be delivered (MTEF delivery quantum targets)

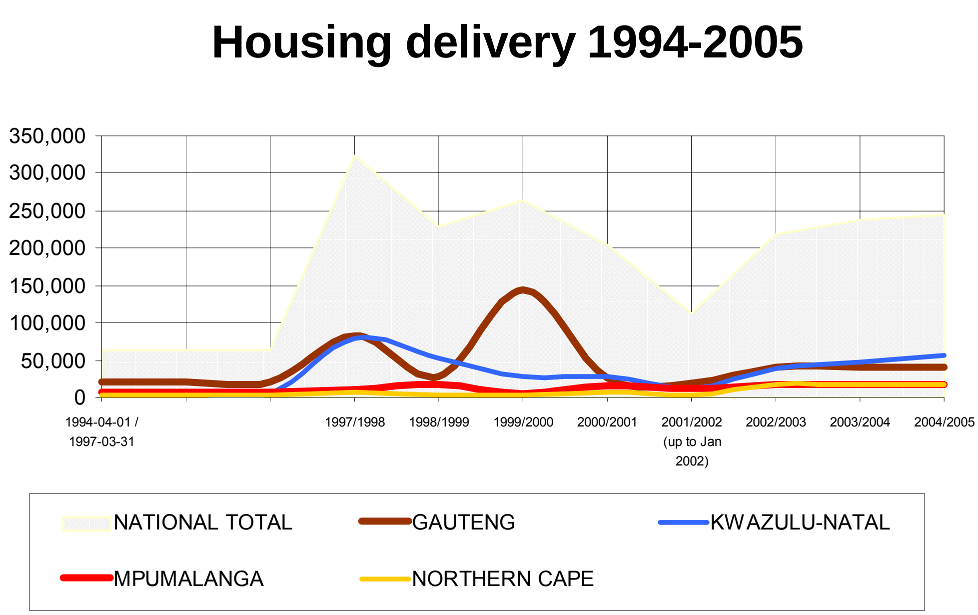

Figure 5 Total RDP housing delivery till 2005 (Development Works 2002)

1.5. Flow of housing subsidies

The prime responsibility for national government in this respect is the formulation of the housing policy. Provincial government implements the housing program, while local government creates an enabling environment to ensure that housing delivery takes place in its area of jurisdiction.

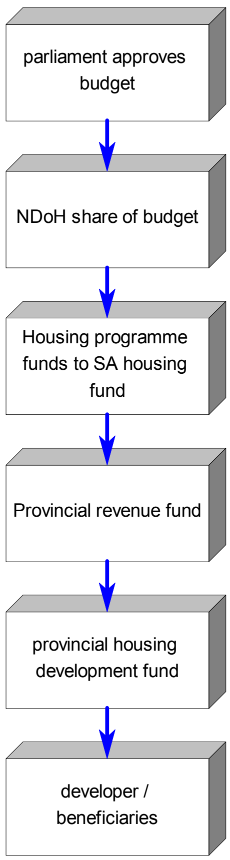

Figure 6 Flow of subsidy funds

Application of each type of subsidy is made to the Provincial Housing Development Boards (PHDB) or the Provincial Department of Housing in those provinces that no longer have a PHDB. The Act envisages that application can be made to accredited municipalities. The responsibility for administrating the various subsidy mechanisms presently vests in the Provincial Housing departments. Once a municipality is accredited it becomes responsible for subsidy administration.

All National Housing Programmes are financed from the South African Housing Fund (SAHF). The money in the SAHF may only be used to finance National Housing Programmes and may not be used to finance the administration of provincial housing departments.

The Minister of Housing allocates money from the SAHF to the provinces based on various criteria, including the province's backlog, past performance and the number of households in the various subsidy bands. This is paid, via the Provincial Revenue Fund, into a Provincial Housing Department Fund (PHDF). Not all provinces have established a PHDF. In such cases, the Provincial Housing department will fund various projects drawing down on the monies set aside in the Provincial Revenue Fund. Funds are claimed in advance of expenditure based on annual cash flow projections.

As can be seen in the flow chart, at the moment no money flows to municipalities. The provinces pay directly to developers. Although municipalities sometimes act as developers, the work is usually performed by contractors acting on their behalf. In most instances provinces still pay the contractors directly, but only after the municipality has certified that the invoices are correct. In such cases the municipalities are simply the conduits between the contractors and the provinces. From time-to-time municipalities that act as developers will also provide bridging finance. In other words they will pay the contractor from their own funds and then submit a claim to the provinces.

The Act also provides for funds to flow to accredited municipalities, who then disburse funds directly to contractors. Funds flowing to accredited municipalities flow via the relevant PHDF. An accredited municipality thus effectively acts as an agent for the provincial government (Deloitte&Touche 2001).

1.6. Role and functions of provincial government and municipalities

This paragraph outlines the roles of the provincial government and local municipalities and is largely based on (Deloitte&Touche 2001).

1.6.1. Provincial government

Housing is regarded as a concurrent competence of national and provincial government. As a result provincial governments can enact housing legislation that is not in conflict with national legislation, policies and procedures.
Provincial government is tasked with promoting and facilitating adequate housing within the framework of national policy. In support of this objective, provincial government must:

- determine provincial policy in respect of housing development,
- adopt provincial legislation to promote effective housing delivery,
- co-ordinate housing developments in the province,
- strengthen the capacity of municipalities to effectively perform their housing delivery duties,
- intervene where a municipality cannot or does not perform a duty imposed by the Act,
- prepare a multi-year housing delivery plan, and
- assess applications for accreditation and monitor accredited municipalities

One of the key responsibilities of provincial government in respect of housing is the administration of the National Housing Programmes. Some of the main functions undertaken by the provincial government, regardless of the type of subsidy or programme are:

- assessing applications for assistance based on the criteria laid out in the Housing Code,
- undertake contract negotiation and subsidy agreements with developers, individuals and institutions,
- administer progress payments via the Housing Subsidy System,
- monitor project implementation via the Perform Developer System,
- screening beneficiaries to prevent double subsidisation, using the National Housing Database System, the Deeds Office and the National Population Register, and
- capturing and verifying source data for the National Housing Subsidy Database.

1.6.2. Municipalities

In terms of the Housing Act every municipality must effectively pursue the delivery of housing in its area of jurisdiction. To this end, every municipality is obligated to:

- ensure that conditions not conducive to the health and safety of the inhabitants of its area of jurisdiction are prevented or removed,
- ensure that services in respect of water, sanitation, electricity, roads, storm water drainage and transport are provided in a manner that is economically efficient,
- set housing delivery goals in respect of its area of jurisdiction,
- identify and designate land for housing development,
- create and maintain a public environment conducive to housing development which is financially and socially viable,
- promote the resolution of conflicts arising in the housing development process,
- provide bulk engineering services, and revenue generating services in so far as specialist utility suppliers do not provide such services,
- plan and manage land use and development, and
- initiate, plan, co-ordinate, facilitate, promote and enable appropriate housing development in its area of jurisdiction.

The Housing Act empowers municipalities to participate in national housing programmes by:

- promoting a housing development project by a developer,
- acting as a developer in respect of planning and execution of a housing development project on the basis of full pricing for cost and risk,
- entering into a joint venture contract with a developer in respect of a housing development project,
- establishing a separate business entity to execute a housing development project,
- administering any national housing programme in respect of its area of jurisdiction, if accredited, and
- facilitating and supporting the participation of other role players in the housing development process.

1.7. Government sponsored institutions

South Africa has established a range of facilitative institutions to facilitate the housing delivery process as a result of the 1994 Housing White Paper. These institutions do include:

- National Urban Reconstruction and Housing Agency (NURCHA),
- National Home Builders Registration Council (NHBRC),
- National Housing Finance Corporation (NHFC),
- Social Housing Foundation (SHF),
- The Rural Housing Loan Fund (RHLF),
- Servcon Housing Solutions,
- Thubelisha, and
- Peoples' Housing Partnership Trust (PHPT).

Each of these institutions will be described briefly hereafter.

1.7.1. National Urban Reconstruction and Housing Agency (NURCHA)

NURCHA was established in May 1995 as a Presidential Lead Project to facilitate access to finance for subsidy-linked housing projects. It shares financial risk with financial institutions and housing developers in order to encourage housing development. NURCHA provides grant funding for capacity building of small and medium scale enterprises involved in housing delivery. NURCHA also provides guarantees to banks lending finance to housing projects, i.e. bridging finance, guarantees for working capital loans for low-income housing projects, as well as guarantees for home loans. In addition to this, NURCHA has started to give guarantees to rental projects. The risk of providing such guarantees is shared on a proportional basis between NURCHA and the financiers of the housing projects. NURCHA aims to prove that guarantees are not risky and that these can be taken over by the financial sector and operated on a commercial basis. NURCHA has provided guarantees on projects run by small, emerging contractors, private sector developers, non-profit developers, NGOs and community trusts.

1.7.2. National Home Builders Registration Council (NHBRC)

The main aim of the NHBRC is to protect consumers and to regulate homebuilders, as well as to raise construction standards. All housing builders must register with the NHBRC and agree to provide a five years' warranty on their work.

1.7.3. National Housing Finance Corporation (NHFC)

The NHFC was established in 1996 by the government to search for new and better ways to mobilise finance for housing from sources outside the State in partnership with the broadest range of organisations. The NHFC supplements its own capital with loan from life assurances, pension funds and other savings institutions. These funds are than channelled to other institutions who, in turn, grant loans to individual low-income earners or provide housing on a rental or other tenure basis. The financial products offered by NHFC to the institutions are for example loans, guarantees and capacity building. Since NHFC does not have access to subsidies it offers its financial products at market conform interest rates.

1.7.4. Social Housing Foundation (SHF)

The Social Housing Foundation was established in 1997 through NHFC to promote, support and assist integrated process of sustainable social housing in South Africa. The SHF focusses its support on assisting the emergence of new social housing institutions. The organisation is now involved with more than 50 social housing initiatives, providing various services through its capacity building programmes. In addition to providing technical support, the SHF integrates specific training programmes to develop capacity of these emerging institutions. Government's support for social housing was articulated in late 1995 with the introduction of the institutional subsidy mechanism, to encourage the production of housing for rent, and broaden the range of tenure options available to low income earners. Large-scale delivery through social housing is not achievable in the short term. This is partly due to the intensive capacity requirements of establishing social housing institutions as well as the long lead-in time for these institutions to reach sustainability.

1.7.5. The Rural Housing Loan Fund (RHLF)

The RHLF is a wholesale lending institution that creates new financial arrangements and opportunities for rural families to improve their housing, economic and living environment. The RHLF mission is to enable lower income families to have access to loans on a sustainable basis to provide flexible solutions for building or improving their homes in rural areas. The RHLF operates through retail lenders that are finding innovative ways to make home construction and improvement finance accessible and affordable in rural areas, small towns and secondary cities.

1.7.6. Servcon Housing Solutions

Servcon assists households who have defaulted on their loans to resume payment in a way mutually acceptable to to the household and the financial institution involved. A number of repossessed houses are included in the portfolio of Servcon.

1.7.7. Thubelisha

The primary function of Thubelisha is to provide alternative affordable accommodation to rightsizing clients in the Servcon portfolio who have signed “rightsizing” agreements with Servcon, and complied with their interim payment arrangement.

1.7.8. Peoples’ Housing Partnership Trust (PHPT)

The PHPT was established to facilitate the government’s peoples’ housing process. The mission of the organisation is to build the capacity of provincial governments, municipalities, NGOs, CBOs, tribal support organisations which can potentially support the Peoples' Housing Process (PHP) by enabling them to provide support services to beneficiaries in both rural and urban settings. In order to achieve this the PHPT promotes public awareness of the PHP through information sharing, provides training and technical support to support organisations and develops a bank of information, documentation and tools on the PHP accessible to the government, support organisations and communities.

2. Principles of energy efficiency in housing

Energy efficient techniques, or interventions, in housing involve the application of energy flow principles and climatic characteristics of a region in the design, construction and management of houses so as to achieve thermal comfort and other energy- and water services, with minimal conventional energy or water input (Irurah 2000). This report focuses on energy only, as water use is beyond its scope.

Where possible and available an indication of the costs and the benefits has been given. In the table below the different 'costs of intervention' ranges have been listed.

Costs of intervention	Price range (R)
Low	0 – 50
Moderate	51 – 500
High	500 – 4000
Very high	> 4000

Table 6 Price ranges of interventions. Source: (DoH 2000b).

2.1. Passive thermal design

Passive thermal interventions are based on the principle of energy efficiency, as defined above. The basic components of passive thermal design incorporate the orientation of the houses, optimising natural sunlight through daylighting and utilising thermally efficient building materials. Including these principles would be a low cost or no cost intervention and would be applicable to all climatic regions in South Africa.

Figure 7 Passive solar design will reduce the energy use (IIEC 2001).

2.1.1. Orientation of houses

The additional expenditure utilised for heating due to wrong orientation in low-income housing is up to 48% of households' expenditure (Irurah 2000). Passive solar design can reduce these expenses and requires that houses in the Southern Hemisphere should face towards geographic north (±15°) in order to obtain optimal solar benefit. This means that the longer axis of housing units should be orientated as near to the east-west axis as possible (DoH 1999). Houses which are north orientated and have most windows facing north would have the least heat gain in summer and the least heat loss in winter, so that the indoor air temperature remains comfortable. Although debates by some, the correct orientation of houses should involve limited direct costs only. It should be an integral part of planning and design and a deviation from this rule should be motivated.

2.1.2. Building materials

Passive thermal design also entails using appropriate building materials, such as materials with a high thermal mass (thermal capacity), which are able to store heat during the day and release this heat slowly at night. Materials of high reflectance should be used to reflect solar heat (Irurah 2000). The current trend in low cost housing in South Africa is to use hollow cement blocks for walls and concrete surface beds for flooring, which both have reasonable thermal capacities. Alternative materials such as earth bricks have higher thermal capacities, but have been rejected by communities in earlier projects, as they are perceived to be inferior materials (Walker 1999). Recently earth bricks seem to enjoy better acceptance. Examples of the use of earth construction can be found at the Midrand EcoCity (see page 23) and at the Tholego development (see page 24).

The most common materials used for roofing are fibre cement and metal sheeting. Some fibre cement products contain white asbestos. The Department of Housing (DoH 1999) states that building products containing asbestos should be avoided wherever possible and has issued studies into alternative roofing materials. Metal sheeting is one of the alternative to asbestos, but the heat loss and gain of metal sheeting is extreme. Traditional housing, both low and high income, have a thatch roof, which gives excellent insulation.

2.1.3. Daylighting

Daylighting refers to optimising natural sunlight through glazed areas during daylight hours in such a way that heat gain is minimised in summer and heat loss is minimised in winter (Irurah 2000). Solar radiation is transmitted through glass, since it is transparent. This radiation converts to heat when it strikes materials, such as concrete floors, and is then re-radiated as heat. According to D. Holm (Holm 1996), the size of glazing should be approximately 20% of the total floor area (exact figure depending on the climatic circumstances), on the northern side of a house for 'solar collection' to provide the most favourable thermal efficiency. There should also be a minimal window surface facing the south, east and non-west. Double-glazing is a thermally efficient principle, which is a common practice where winters are long and cold. However, this technology is rarely used in South Africa, mainly due to its availability (Irurah 2000). This is based on the prevailing English tradition in residential housing in South Africa coupled with the perception that energy is cheap. However, the availability has recently been improved, enabling a wider implementation.

In the inland areas of South Africa the material used for the window- and doorframes is metal, which is conducting the heat. Only in the coastal areas where corrosion is a problem, wood is being used. In general it can be said that wood gives a much better insulation than steel but is seldom used inland because of the availability and costs of this material.

2.1.4. Roof overhang

The northern orientation of houses should be coupled with a roof overhang on the northern side of the houses throughout South Africa, designed according to the summer and winter angles of the sun. The size of the roof overhang depends on the roof geometry, but should be about half a meter in length to shade the northern windows from the sun during the summer months and to allow the sunrays to penetrate in winter, when the sun is lower on the horizon (Garner 1999). Roof overhang should be combined with a strip of preferably grass or vegetation around the houses to prevent the surface from warming up. This is a low to moderate cost intervention.

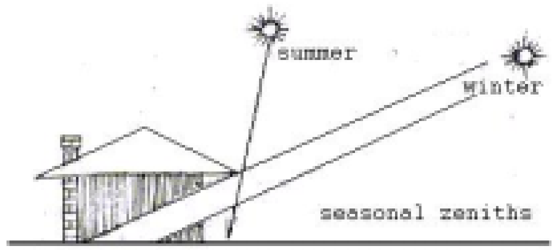

Figure 8 Roof overhang to prevent overheating in summer without sacrificing solar benefit in winter

2.2. Weatherisation and ventilation

The construction quality of the current RDP houses is not of a very consistent high standard. More often than not, gaps can be found between door and doorposts, windows and windowframes and between the walls and the roofs. These gaps are a source of excessive heat-loss. Tightening the building envelope is a pre-requisite for an energy efficient home, as all effects of other interventions will be minimised when all heat gained is lost immediately. The process of tightening the building envelope is referred to as weatherisation.

While closing all air gaps, sufficient ventilation needs to be ensured. For this purpose airbricks can be installed. Inadequate ventilation leads to dampness in houses, particular in the Cape condensation zone Dampness is related to respiratory diseases and higher heating costs. Heat is wasted through evaporation before the house starts to warm up. Airbricks should be placed in relation to windows in order to maximise cross ventilation (Holm 1996). Ventilation problems still arose in some houses where airbricks were installed, because the inhabitants seal them off. The installation of airbricks is a low cost intervention.

Figure 9 Air gaps between the door and doorpost lead to excessive heat losses

2.3. Ceilings

Installing ceilings is critical in order to achieve a thermally efficient low cost houses. With their ability to trap air, ceilings ensure a reduction of heat flow into or out of the house. As a result, the house is warmer in winter and cooler in summer. The cost of a traditional ceiling is in excess of R 40 per m^2 (Baloyi 2000), while new innovative low cost ceiling can be as cheap as R 20 m^2. Ceiling insulation is a moderate to high cost intervention, but an absolute necessity.

Besides the positive effect on the required amount of energy for space heating, ceilings have a number of additional benefits: improved aesthetics of the interior, better illumination of the house, less condensation on the inside of the roof and a reduction of the infiltration of dust.

Figure 10 Innovative ceiling products can reduce the investment by 50%. Photo: (Pal, Geurtsen et al. 2000).

2.4. Wall insulation

There are various methods to insulate a wall. Building a cavity wall is seen as the most effective method of insulation, but it is also the most expensive method and therefore not widely applied. Another way of insulation is to plaster walls. Most RDP houses consist of a single skin of hollow cement blocks and plastering is regarded as the most effective method to insulate these walls. A plastered wall is better resistant to moisture and prevents the mortar of a wall from cracking. In this way, plastering reduces maintenance costs and energy usage costs. Plastering costs approximately R1000 for a 30 m^2 RDP house (Walker 1999).

Cemcrete, which is a cement-based external paint, is a slightly cheaper alternative to plastering. However, cemcrete needs to be applied strictly and accurately, according to the instructions and not watered down, as is usually done to cut costs. Watering down the cemcrete negatively effects the effectiveness and the quality (Walker 1999).

Another way of insulation is by using panels, also called construction boards. These panels are either used as an add-on to the walls and thus function as in insulation layer or fulfil the wall function themselves and have a structural function. Communities often reject panels, which are usually made out of polystyrene or fibre-cement, because they are considered inferior or artificial building materials. However, from a thermal efficiency point of view, applying polystyrene on the outside of a cement blocks wall is a good proposition, as the thermal mass of the wall will be on the inside of the house.

2.5. Flooring

Floors are an important component to achieve thermal efficiency in houses. Flooring material should be of high thermal mass, such as concrete, bricks or clay, to trap heat and solar radiation coming in through windows. The heat is slowly released at night. Single storey residential units can basically use their surface bed (consisting of the floorslab and the soil underneath it) as thermal mass. Multi-storey residential blocks have the disadvantage in this respect of having one level with these characteristics and the others without. Adding thermal mass in these floorslabs by adding material beyond constructional requirements involves high costs and is often considered to be too expensive.

2.6. Shared walls

Shared walls, either in the form of a row of houses or semi-detached houses, saves on the costs of the housing shell as well as on energy consumption. When units share walls, they provide more insulation against heat loss in winter and heat gains in summer than the single housing units. However, some communities do not accept shared walls and argue that 'One must be able to walk around its house, otherwise it is not a house'.

Figure 11 RDP houses sharing walls to save on construction costs and energy consumption. Source: (Jongeling 2001).

3. Experience with energy efficient housing in South Africa

In South Africa several projects on energy efficient housing have been implemented. Many of them including other aspects of sustainable living as well, such as water or waste related issues.
Unfortunately all these projects are stand-alone activities with limited or no interaction.

This chapter gives an overview of the past and present projects on energy efficient housing. Up till now such an overview is not available and all information for it needed to be collected from different sources over the country.

From the analysis of these projects and discussions with directly involved experts, it became clear that non of the projects mentioned has done a proper evaluation of the energy savings achieved, by means of an energy use analysis. Only PEER Africa in its Kutlwanong housing project has made a start with data collection on the energy performance of the houses. This analysis is in the starting phase only, with no processed data publicly available. Wits University has started a close monitoring of energy use in the SOWETO eco-house, but has no data available as yet. Furthermore the Mabopane project was evaluated on energy use, but as this project involved thermally improved shacks, the outcomes are of limited relevance for this study.

The following projects will be described briefly (in random order):
- All Africa Games Village, Alexandra
- Krugersdorp Housing project
- Kutlwanong Eco-housing project, Kimberley
- Ivory Park insulated ceiling demonstration project, Midrand
- Embalenhle air pollution reduction project
- Mohlakeng, Ext. 2, Randfontein
- Thermally improved shacks, Mabopane
- SEED housing Cape Town
- Tlholego
- Alexandra East Bank Housing Development
- Marconi Beam Trust Demonstration Village, Cape Town
- SOWETO eco home
- Shayamoya - Cato Manor, Durban
- Missionvale, Port Elizabeth
- Waterloo Development Project, Verulam/Umhlanga (near Durban)
- Hull street development / Moshoeshoe eco-village, Kimberley
- Dutch AIJ (Benoni, Kimberley, Cape Town, Lady Grey)
- Low-cost urban housing upgrade, Khayelitsha, Cape Town
- Rural hamlets in Stellenbosch
- Clean SOWETO Air Fund

3.1. All Africa Games Village, Alexandra

The All Africa Games Village consists of 1799 housing unit on a 75,000 m^2 village. The units were originally built as accommodation for the athletes of the All Africa Games in 1999, to be converted into housing units afterwards. The total cost of the project in Alexandra (Greater Johannesburg) was R 80 million, which takes into consideration energy and water efficiency measures that were donated by ESKOM and Rand Water. The village consists of three types of houses put together in different configurations. They have respective areas of 32, 42 and 50 square metres.

The project features passive solar design with all facades facing north to maximise utilisation of the solar irradiation. However, to satisfy assumed end-user perception, south facing windows were made slightly lager than the recommended size for maximal thermal efficiency. The roofs are light in colour to ensure units remain cool in summer. Darker colours were used on the walls to improve thermal efficiency. Roof overhangs on the north walls are within 150 mm of the 500 mm overhang regarded as optimal for protecting the houses' interiors from direct sunlight heating. The discrepancy is due to the standard length of roof sheets available. Mono pitch houses or double pitch roofs were insulated with 50 mm of ceiling insulation to increase thermal efficiency by providing an air cushion between the roof and ceiling board which function as an extra layer of insulation. The interiors and exteriors have been coated with a special plaster paint to prevent warm air from escaping through air leaks during winter. In addition the housing units have 60 Watt equivalent compact fluorescent lamps for internal lighting and vertical water heaters instead of the conventional horizontal ones, giving an efficiency improvement of 10%.

Unfortunately the current users are not instructed on the specific requirements of the energy conscious design of their homes. No monitoring has been done on the thermal performance of the houses built. Main reason being the rather tight schedules the whole village was subject to and the late moment energy efficiency was introduced by an outside group. At this moment an effort is ongoing to do a proper energy consumption survey in the All Africa Game village to evaluate the effect of the energy efficiency interventions. Sources: personal communications, (Mahomed 2000) and (Napier, Austin et al. 2000)

3.2. Krugersdorp Housing project

This project in Krugersdorp (Gauteng) covers 18,000 houses with a combination of water conservation and energy efficiency measurements. Total cost per house were the Government RDP subsidy plus R 14 000 additional costs per house.

The energy efficiency measurements include:
- insulated ceilings
- passive solar design
- use of fluorescent light bulbs

Electricity consumption savings are expected to range from 25 - 30 %, equating to a monthly saving of R 15 to R 20 per household (Napier, Austin et al. 2000).

3.3. Kutlwanong Eco-housing project

This project started as a self-help programme for a local community in Kimberley, Northern Cape, emphasising 'decent housing and jobs'. In total two hundred houses of 52 m^2 each[3] were built, incorporating energy efficient measures and passive solar design techniques using the "Peoples' Housing Process" (PHP). The PHP required housing support centre was established as the "Kutlwanong Civic Integrated Housing Trust" (KCIHT).

Each house is designed to incorporate the following features:
- northward orientation,
- window sizing to maximise thermal benefit in winter when the sun is low on the horizon,
- roof overhang to shade windows during summer when the sun is high near the zenith,
- insulated ceilings to make the house warm in winter and cool in summer,
- wall cavity insulation to further prevent heat loss in winter and heat gain in summer.

The insulation material used is polystyrene.

By the year 2000 over 200 energy-efficient housing units had been developed. The first type made use of a cavity wall with insulation sandwiched between two brick skins, the second type was built of steel frame with wall insulation sandwiched between an internal layer of gypsum board and an external brick layer.

The designers expect a reduction of 70 % in the energy requirements for space heating. Unfortunately the measurement data collected on energy use in the homes has not been released yet, making it impossible to verify these claims.

The Kutlwanong case is a partnership between the following parties, co-ordinated by the KCIHT:
- technical support from PEER Africa,
- subsidy finance from provincial government,
- funding from USAID to pay the additional capital costs of energy efficiency interventions,
- land from the Kimberley municipality, and

[3] This 52 m^2 was the standard size of RDP houses at the start of the project (compared with 30 m^2 today).

- sweat equity from the beneficiaries.

Source: (Abron and Guy 2000), (Napier, Austin et al. 2000), (DoH 2002a) and (Irurah 2000)

3.4. Ivory Park insulated ceiling demonstration project and mud brick house

The Midrand EcoCity is a Danida supported ambitious project to convert Ivory Park into a "Green city". Several initiatives are combined in this EcoCity, one of them being an insulated ceiling demonstration project. At a cost of approximately R 50,000 thirty houses were equipped with a new innovative ceiling with insulation material thinner than conventional ceilings.

It comprises of a polyminium sheet (a white woven plastic sacking-type of material with a reflective backing) glued to the "aerolight" to give it a thin base. The insulated sheet is nailed to the wall using a wooden cleat to avoid sagging. In winter, the insulated ceiling prevents water condensation and thus keeps the house warm. During summer it prevents excessive heat and thus keeps the house cool. In this pilot an installed cost of R 20/m^2 is estimated, as opposite traditional ceilings (e.g. gypsum board) which cost in excess of R 40/m^2. Energy savings of 30% to 60% have been measured. For a photograph of this ceiling material, please refer to page 19.

Also in the Midrand EcoCity is the initiative for mudbrick houses. Twenty Ivory Park residents built a mudbrick (mud and straw) demonstration house in the EcoCity, in partnership with students from the University of Twente in the Netherlands, Wits University, DFID as well as the Midrand Local Council. There has been mixed feelings around this mud brick demonstration unit. (Napier, Austin et al. 2000), (Baloyi 2000), (Mahomed 2000) and (Sugrue 2000)

Figure 12 & 13 Midrand EcoCity mud brick house during construction

Figure 14 & 15 The mud brick house after completion and painting

3.5. eMbalenhle air pollution reduction project

Based on the fact that indoor air pollution levels in the low-income houses in South Africa are multiple the maximum levels acceptable to the World Health Organisation (WHO), several attempts have been initiated to introduce cleaner fuels for the townships. None of the past initiatives in that direction was very successful. The eMalenhle air Quality project started to work on this issue together with the residents. The NOVA institute worked together with 40 informal houses near Secunda to investigate the use of cleaner fuels. Part of the intervention was insulating the houses concerned, reducing the cola consumption between 5 and 30 %. This not only reduced the indoor air pollution levels, but also led to a reduction in pollution levels outside and in the settlement as a whole. People also like insulation because it helped to keep dust out of the house and helped to "create a real home" (DoH 2002a).

3.6. Mohlakeng, Ext. 2, Randfontein

A commercial developer's plan was taken as control group to be compared with thermal improvements designed by Holm Jordaan partners, commissioned by the Department of Minerals and Energy. The interventions included orientation, window sizing and shading, roof insulation and end users capacity building. The improved houses surprisingly cost 2% less to build (Irurah 2000).

3.7. Thermally improved shacks, Mabopane

The thermal performance, comfort and energy usage of these shacks was monitored during summer and winter. Reflective insulation was then installed in a capacity building programme, after which the monitoring repeated. The simulations and field measurements showed that energy for space heating was more than halved and change to paraffin took place (Irurah 2000).

3.8. SEED housing Cape Town

The SEED programme in the city of Tygerberg context is known as the Build and Life Safe Programme and is aimed at improving energy and environmental issues in low cost housing projects as well as informal settlements. A new village with more than 2300 homes is soon to be built in Khayelitsha (Cape Town). Information will be provided on, amongst others, the benefits of ceilings, energy efficient lighting and appliances and how to extend the starter house in a safe and sustainable manner (Irurah 2000).

3.9. Tlholego

This experimental and training centre 13 km west of Rustenburg in the North West province, erected demonstration buildings of adobe.
Tlholego is the Tswana word for "creation from natural origins". The project is a far-reaching endeavour that spans the concept of environmental education, ecological villages and sustainable rural development. On the housing issue, the project has sought to replace the sub-standard farm worker housing with more sustainable, acceptable houses. A low-cost, high-quality mudbrick technique has been developed at Tlholego with the assistance of technical expertise from Australia.
The excellent thermal performance achieved by the use of the mudbricks suits very well with the extremes of hot and cold experienced in the region. Principles of solar passive design are also implemented, using north orientation and roof overhang. The project team estimates that a reduction in heating and cooling costs of 50 % will be possible.

Trainers from Tlholego have been involved in other earth construction initiatives in the country, like for example in the Midrand Ecocity.

The Tlholego houses achieve significant cost-effectiveness through two mechanisms. First, the earthbricks are fabricated from natural materials on-site, and thus reduce the reliance upon costly outside suppliers. Second, the Tlholego housing approach uses labour and skills from the community, which again reduces the costs and helps keep the economic benefits with the local residents. The 45 m^2, two bedroom houses are being constructed for R 12,000, well within the housing subsidy provided by government.

Unfortunately the initiative suffers from a low acceptability of the sustainable livelihood technologies, especially the earth brick/adobe houses and composting toilets, within the settlement and elsewhere in South Africa.

Source: (Irurah 2000), (Spurr 2000) and (DoH 2002a).

3.10. Alexandra East Bank Housing Development

The Alexandra East Bank Housing Development, located in Alexandra in Johannesburg, South Africa, constitutes approximately 1200 low-cost houses. The main intervention on energy efficiency is the north orientation of the houses (Beyers 2000).

3.11. Marconi Beam Trust Demonstration Village

At the Marconi Beam Trust Demonstration Village, the Department of Minerals and Energy (DME) facilitated a thermally efficient house in 1997. The experience was an attempt to introduce an insulated block construction method and other interventions - such as ceilings, properly sized windows, etcetera.

A small 100 litres direct heating close-coupled solar water heating system was donated by Sol Energy and installed on the house of the supervisor of the demonstration village.

Although some monitoring and evaluation of the house was envisaged, this did not materialise due to the lack of DME budget.

Due to the fact that the original houses has been added on to recently, both in the front (West) and the back (East), much of the original thermal efficiency was lost. (Glynn Morris, personal communication)

3.12. SOWETO eco home

The University of the Witwatersrand (WITS) and PEER Africa initiated the Soweto Eco House Project in Soweto, Johannesburg. It forms part of the larger WITS Soweto Clean Air Monitoring Project. The project constitutes the construction of one pilot energy efficient house by local emerging contractors. The project team set out to design an energy efficient house according to passive solar design and water efficiency principles. The house will serve as a model house for monitoring and measurement purposes. To succeed in building such a house, the project team paid close attention to the design of the building envelope, the fitting of all relevant energy efficiency technologies, as well as water conservation and energy efficiency water heating practices.

Passive design is employed by orienting the house so that the main rooms face north, to maximise solar radiation to heat and cool the house during the different seasons. The north facing windows have large panes to allow maximum sun penetration and a 600 mm roof overhang on the same side to shield the windows from direct radiation in summer. The building envelope is made of two 140 mm brick walling skins with a 25 mm X-grade polystyrene insulation placed against the inner skin and a 50 mm space between the insulation and the outer skin wall. The floor in the main living areas is finished with dark ceramic tiles for enhanced thermal storage. Light coloured roof tiles were used as they reflect intensive heat during summer. 75 mm Polystyrene was used to insulate the ceiling.

This first energy efficient house in Soweto will also serve as demonstration house in Gauteng for energy efficiency. It is further functioning as a test house for the air quality monitoring project in Soweto.

The Eco home in SOWETO is a house for the middle-income sector and is under intensive monitoring at this moment to evaluate the effect of the interventions.

Source: (Beyers 2000) and (DoH 2002a)

3.13. Shayamoya - Cato Manor, Durban

This pilot social housing project of 320 high-density (gross density of 110 units per hectare) residential units is being built on a greenfields site in Cato Manor to cater for affordable rental accommodation in 2 – 3 storey row housing and flats. Besides the subsidies, top-up financing in the form of a grant from the Malaysian Government (R11, 3 million) has been secured. Project features include north orientation where possible, air ventilation, the placement of two shops in the settlement that will be rented out. Cato Manor is well located in terms of transport and its relation to central Durban. This project has recently laid its first foundations for half the project. Even this well funded project is finding it difficult to consider a solar water heater pilot project or dual flush toilets due to initial capital costs and structural problems, they are however investigating compact fluorescent lighting in the housing. It is important to note that the design and layout of the structures mitigated against the use of SWH and reflects the importance of considering theses aspects upfront (Mahomed 2000).

3.14. Missionvale, Port Elizabeth

Although not an energy efficient housing project per se, the Missionvale projects illustrates the possibility of shared wall for reduction of energy.
Missionvale implemented by Metroplan in Port Elizabeth, is a high density residential project that used economies of scale, the sharing of services and splitting of erven to obtain 36 – 56 square metre units of eight different structures. Missionvale is well located on valuable land. The Delta Foundation sponsored research and development and post construction support as some bulk servicing. An innovative lottery system helped allocate single storey houses to the elderly and infirm and bigger double storey units to younger bigger families. This is a completed project and families are settling in well, with some already having established gardens (Mahomed 2000).

3.15. Waterloo Development Project

The Waterloo Development Project has sought to create an alternative approach to low-income housing provision. The project team has placed resident education and choice at the centre of the process. By informing residents of all available options and providing demonstrations, the community is empowered to shape their own future. Through the Australian development association (AUSAID), the local community was helped pioneering earth construction techniques in Waterloo. The Waterloo Housing Support Centre is constructed out of earth bricks, demonstrating the effectiveness and appeal of the technology. The centre assists the local community with all housing related issues, ranging from accessing housing subsidies to providing house plans and training in construction related skills (Spurr 2000).

3.16. Hull Street development / Moshoeshoe eco-village

The Sol Plaatje Municipality (formerly the Kimberley Municipality) has implemented an eco-village as the demonstration phase of a much larger (>2500 units) urban low-an-middle income housing project called The Hull Street project. The eco-village, called The Moshoeshoe Eco-village, comprises of 13 units located on land adjacent to the Housing Support Centre in Galeshewe. The eco-village includes a range of innovative housing solutions and was facilitated by rant funding from Sida. The Swedish ambassador formally opened it on the 12th of March 2002.

The buildings are designed with a compact form to minimise the heat gains and losses through the roofs and walls by minimising the ratio of surface area to volume. The orientation of the buildings is with the length of the buildings in the east / west alignment. Furthermore, the buildings have ceilings to minimise heat gains and losses through the roofs. Other passive solar design features include appropriate roof overhangs, thermal mass, light coloured roofs and window design.

Lighting inside the houses is provided by compact fluorescent lights (CFLs) and all other energy uses are optimised, including the use of solar hot water systems. Included in the eco-village are a solar PV and wind generator that supply excess electricity to the national electricity grid using net-metering.

3.17. Dutch AIJ (Benoni, Kimberley, Cape Town, Lady Grey)

The Dutch IDA funded AIJ project "Housing for a Healthier Future in South Africa" was managed by IIEC South Africa and PEER Africa and completed four demonstration houses at four different locations each. The four locations were selected on their climatic differences: Benoni, Kimberley, Cape Town and Lady Grey. The project aimed at incorporating Dutch expertise in energy efficiency measures (ECN - Energy research Centre of the Netherlands) and Dutch energy efficient construction materials. Extensive monitoring of the completed houses on their energy use was part of the original project document, but this did not take place within the project. The monitoring has been contracted separately to the Palmer Development Group for execution in 2002.

Figure 16 Energy efficient houses in Lady Grey (photo: Tony van Engelen/Planet)

Figure 17 & 18 Brick house with cavity wall at Benoni

Figure 19 & 20 Innovative new materials for energy efficient houses in Benoni

Main interventions in Lady Grey are orientation, roof overhang and ceilings at an intervention cost of R 3000 per house. Cost details of the interventions at the other sites are not available.

3.18. Low-cost urban housing upgrade, Khayelitsha, Cape Town

This proposed project is an addition to a greenfield housing project introducing lighting, thermal performance and water heating efficiency improvements in 2309 new low-cost houses in Khayelitsha near Cape Town.

According to the project proposal, the project aims at a reduction of 39.3 tons of CO_2 per household at a cost of R 3882 per house on top of the national housing subsidy of R 16 000. The cost of carbon mitigation is US$ 12.36 / ton CO_2.
The table shows baseline and alternative costs and emissions (calculated on the basis of each household unit, a project life of 50 years and without any discounting).

Item	**Baseline**		**CDM alternative**		**Balance**	
	tons CO_2	**Initial costs**	**tons CO_2**	**Initial costs**	**tons CO_2**	**Initial costs**
Water heating	45.90	1000	18.36	3500	27.54	2500.00
Space heating	21.48	0	10.74	1376	10.74	1376.00
Lighting	1.32	48	0.33	54	0.99	6.00
Total	**68.71**	**1048.00**	**29.44**	**4930.00**	**39.27**	**3882.00**

Table 7 Emissions and costs of baseline and CDM alternative

The basis of the calculations is:
- Appropriate solar water heaters, purchase and installation in 2309 household units.
- Appropriate ceiling insulating materials as well as other possible appropriate building materials to be installed during construction.
- Energy efficient lighting to be installed with fittings at a rate of 2 per household.

Assumptions include:
- All services are based on an electrical baseline;
- Replacement of two 75W incandescent with two 19W CFLs per household;
- Lamps are used for 3.2 hours use per day;
- Expected lifetime of components include:
  - Energy Efficient lighting: 3.2 hours per day for 8000 hours (equivalent to 6.85 years);
  - Solar Water Heaters: Maximum of twenty years; and
  - Ceiling Insulation and Appropriate Building Materials: The life of the house (approximately fifty

years).
- Ceilings and ceiling insulation reduce the energy loss by 50% of a baseline of 390.6 kWhs per year;
- Solar water heaters use electrical back up for 40% of the energy required to heat water (60% solar fraction); and
- Electric hot water storage geysers and solar water heaters have a 70% efficiency (standing losses etc. utilise 30% of the energy transferred to the water).

Source: CDM project proposal by NorthSouthSouth

3.19. Rural hamlets in Stellenbosch

This proposed project is an addition to a greenfield rural hamlet housing project introducing lighting, thermal performance, cooking, water heating efficiency improvements and various improvements in the embodied energy of the building materials to 3700 yet to be constructed dwellings. The project is aimed at upgrading tenure rights for farm workers. The Hamlets are all within a 100 km radius of the Metropolitan area of Cape Town in the Stellenbosch District of the Western Cape. Without CDM intervention, the hamlets would be constructed along the lines of a conventional model, which would be far less sustainable. Examples of recent developments of this nature exist in the Stellenbosch District and are considered as the baseline for a CDM intervention.

The project-proposal claims more than 150 000 tons of CO_2 being avoided over the life of the project at a cost of US$ 12 / ton. The project results in health and cost co-benefits to the household and may be replicable in other intensive farming areas in South Africa.

The following will comprise elements of the CDM project intervention
- Solar water heating through the introduction of solar water heaters instead of electrified geysers;
- The introduction of stoves using LPG as opposed to electricity;
- Efficient lighting with a change from incandescent to compact fluorescent lights;
- Improved thermal performance through:
- Choosing the building materials and components with regard to their embodied energy, toxicity, environmental impact, durability and recyclability taking into account embodied energy in their utilisation and therefore local materials will be used, such as earth bricks;
- Orientation and design for energy efficiency and natural climate controls using passive solar design; and
- The addition of insulation and ceilings in the houses to reduce the need for electrified space heating.
- Emphasis on meeting food, water and energy levels locally;
- Solid waste management that uses recycling on site where possible and thereby reducing trips to and from the landfill site in Stellenbosch;
- Waste-water-Biolytic filtration technology will be used for the wastewater treatment. This technology allows rapid, odour-free environmentally appropriate filtration that produces high quality filtrate without the use of chemicals. This filtrate can be recycled for irrigation or other uses, or discharged into rivers. Methane is emitted when human waste (sewage) is treated anaerobically, for example in anaerobic ponds or lagoons. The Biolytic filtration method would treat the waste aerobically with zero methane production

Source: CDM project proposal by NorthSouthSouth

3.20. Clean SOWETO Air Fund

During the World Summit on Sustainable Development (WSSD) in Johannesburg in August 2002, the Department of Minerals and Energy launched the Clean SOWTEO air fund. This fund focuses on the poor, low-income households in SOWETO that mainly depend on coal as a household fuel. The health and environmental impacts are prominent in these households because of the way coal is being burnt: in open fires, braziers (mbawulas in local language) and in old stoves.

The Clean SOWETO fund will implement some fast track solutions to improve the air quality and fund research on the development and implementation of other solutions.

Issues under consideration for funding by the fund are:
- implementation of alternative ways of lightning coal fired braziers
- introduction of low smoke fuels
- housing insulation
- coal stove maintenance

4. Green financing

Although it worked out different in reality, the national housing subsidy was intended to be supplemented by additional funds from the homeowner. During the implementation of the subsidy programme, it proofed to be very difficult for the prospective homeowners to access mortgage bonds. Several initiative tried to address this issue and are described in this chapter.

4.1. Department of Housing - Green Housing Finance Initiative

The National Department of Housing has initiated a project aimed at creating an enabling environment for the mainstreaming of environmental efficiency in the housing sector. The Green Housing Finance Initiative is part of this project. Funded by Danida, this initiative aims to facilitate access to housing finance for low, medium and upper income households to undertake 'green' improvements in their homes.

The focus of this programme will be on encouraging lending organisations to provide loan funds to households to make green improvements that result in medium and long-term savings. These savings may be in the form of decreased electricity and water bills or decreased maintenance costs. There will also be a focus on initiatives that provide increased comfort and amenities and which provide for a healthier living environment.

The end user group focus for this project will be on all households who are able to undertake debt in order to purchase 'green' materials or appliances. It is understood that households earning under R 800 (an amount to be firmed up in the initial stage of this project) are considered unbankable by most of the financial institutions as they do not earn sufficient income to undertake debt.

One of the major reasons for the lack of 'green' housing finance is the lack of demand. To this end and others, the project will monitor the 'green' initiatives which have already been piloted or used, with a view to developing an understanding of how acceptable these initiatives have been to end-user households, their ease of use, durability and finally the costs savings which have accrued to the household. This information will be written up and maintained in a database. It will be publicised through this programme, with specific information and training packages aimed at households, financial institutions and government departments.

This project is currently in its initial design phase. Danida consultants are currently in the process of writing up a more detailed project document in consultation with all the key stakeholders. The project is expected to commence in February or March 2003 and will be funded with Danida funds for a period of approximately 3 years.

4.2. Development Action Group (DAG)

The Development Action Group (DAG) has as mission to support and implement community housing and development projects and processes and to work towards the creation of an enabling community sensitive policy environment. As part of their ongoing loan scheme, DAG is specifically addressing individual loans to homeowners that what to upgrade their home. Energy efficiency interventions do qualify for a loan amount related to the savings on energy expenditure.

4.3. Commercial banks' initiaves

… information on the Rand Merchant Bank initiative to be added …

5. The role of bi-lateral aid agencies

Within the South African energy efficient housing sector several bi-lateral aid agencies are active in a more or less structural manner.
Bi-lateral agencies involved are:

- DANCED
- DGIS
- USAID
- AUSAID
- DFID

5.1. DANIDA

DANIDA (formally operated through DANCED) is funding a programme on energy efficient building, which includes capacity building for the Department of Minerals and Energy, support to the Urban and Rural SEED initiative, as well as on green financing in the housing sector for the Department of Housing.

5.2. DGIS

The Dutch Directorate General for Development Co-operation has supported the AIJ project "Housing for a Healthier Future" as described in this report (see page 27) and its subsequent monitoring and evaluation. They are approached by a consortium of the current project partners, for support of a follow-up on this project.

5.3. USAID

USAID has funded the research needed for the publication "Environmentally sound energy efficient low-cost housing for healthier, brighter and wealthier households, municipalities and nation, evaluation of performance and affordability of intervention technologies". A consortium of research institutes in the country prepared this study.

Furthermore USAID is co-funder of the Sustainable Homes initiative of IIEC. Through this targeted intervention, IIEC places professionals (e.g., engineers and town planners) in needy communities (for anywhere from an hour to two weeks) to transform standard housing developments into energy efficient, sustainable and high quality settlements (see page 34).

5.4. AUSAID

AUSAID is actively involved in the mud construction of residential buildings by funding activities in this field, including an open Agrement certificate for an earth construction method in which the method of construction is being certified and open to use by everyone. The Tholego development was constructed as part of this effort (see page 24).

5.5. DFID

The UK's Department for International Development is, together with USAID, co-funder of the Sustainable Homes Initiative of IIEC.

5.6. SIDA

The Swedish international Development Agency was the main funder of the Hull Street development in Kimberley and the associated Moshoeshoe eco-village (see page 26).

5.7. GTZ Germany

From 1994 till 2001 the Urban Upgrading and Development Programme (UUDP) has operated in selected small towns in the Eastern Cape and Free State. It aimed at enhancing the capacity of local authorities and community groups to handle housing projects for low-income people, in close co-operation with the national and provincial housing administration. Special emphasis was placed on the People's Housing Process.

The second project, under the auspices of the National Housing Finance Corporation (NHFC) commenced in 1998. NHFC's mission is to promote access by low-income families to private housing finance. Loans from NHFC are retailed by small finance institutions that, unlike commercial banks, operate close to poor communities. With support from GTZ, NHFC created the Capacity and Development Support programme (CDSP). The CDSP seeks to ensure that more small finance institutions are able to retail housing loans to low-income people. The programme designs and facilitates training and advisory services to managers and staff and entails basic knowledge on credit policies and the administration of loans. Innovative credit products are tested and introduced into the market. In contrast to traditional housing credits, they don't need bankable securities, which poor people are generally not able to provide. The project, supported by GTZ, complements a grant of 25 million Euro from the German Government to improve housing for rural households and concessional loans totalling 55 million Euro for housing related infrastructure. They are channelled through the German development bank KfW and the Development Bank of Southern Africa.

6. The role of NGOs

In South Africa several NGOs are active in the field of energy efficient housing, mostly as part of their portfolio of projects. This chapter gives an overview of these organisations.

6.1. International Institute for Energy Conservation (IIEC)

The International Institute for Energy Conservation is an international NGO affiliated with the Civil Engineering Research Foundation (CERF) and originates from the United States of America. IIEC's Africa offices are located in Johannesburg. In the energy efficient housing sector IIEC managed the Dutch AIJ project "Housing for a Healthier Future" (see page 27) and initiated the Sustainable Homes Initiative.

The Sustainable Homes Initiative (SHI) promotes energy efficient and environmentally sound low-cost housing in South Africa. the programme targets policy and decision makers in the construction industry, teaching institutions, communities and professionals through a number of interventions to:

- increase the knowledge base on environmentally sound building principles,
- build capacity around the implementation of these principles, and
- provide technical assistance to incorporate environmentally sound building principles in the design, planning and construction of houses through the Green Professionals Network

As a spin-off of the SHI, IIEC developed an interactive software model (the Eco House Interactive) which is a 'game-like' model that allows the user to design his/her own environmentally sound house based on a set of passive solar design and energy efficiency parameters. Once the house is designed, the model will calculate the summer and winter comfort, summer and winter energy need, cost and payback period associated with the specific house. Apart from providing this information in a fun interactive way, the model provides accurate and specific information to ensure that the user is educated on the basics and benefits of eco house design.

6.2. The Social Housing Focus Trust (SHiFT)

The Social Housing Focus Trust (SHiFT) strives to improve the delivery of social housing, through integrated quality design, quality in construction and an effective and efficient delivery-process, where possible in partnership with communities. SHiFT is a conglomerate of professionals in social housing that would like to see a shift in the current construction practices to become more sustainable. They will do this in the following ways:

- By demonstrating that the design of mass housing starts within the context of the city or the village, then the neighbourhood, the street and the home.
- By demonstrating that in the design process the public interest as well as the interest of the social housing institutions must be kept all times in view.

SHiFT is still in its initial phase.

6.3. Sustainable Energy Africa (SEA)

Sustainable Energy Africa (SEA) is main implementer of the SEED programme. Recently Sarah Ward of SEA has published a book, which includes energy efficiency in housing.

The Energy Book is a practical guide for energy activists, professionals, development workers, community organisers and all people reaching for sustainable urban development. This handbook covers sustainable energy approaches and practices, particularly for housing and public development. It takes us from the big picture of global warming to local issues of energy efficient housing and better energy choices.

6.4. Efficient Lighting Initiative Bonesa

Bonesa, the Sotho work for "illuminate", aims to enhance efficient use of electricity. It is a joint venture between ESKOM enterprises, Africon Engineering and Umongi-Kerabo empowerment group. Bonesa's programme involves public awareness, introducing energy efficient lighting curricula in high schools and tertiary institutions and the provision of energy efficient Compact Fluorescent Lamps (CFLs) to newly electrified consumers.

6.5. Greenhouse project

The GreenHouse project is implemented by Earthlife Africa, a NGO with the primary objective of facilitating NGOs and CBOs working towards the realisation of environmentally and socially just development. One of the key deliverables of the GreenHouse project is the development of a resource centre in the inner city of Johannesburg.

6.6. Sustainable Energy, Environment and Economic Development (SEED)

SEED is a programme focussing on energy, environment and development. Its primary objective is to enhance the capacity of communities and local authorities to address energy and environmental challenges in housing and rural development projects

6.7. Trees for Homes programme

Food and Trees for Africa, a NGO with a long track record of activism in relation to urban greening and permaculture, is the implementing agent for the Trees for Homes initiative. This initiative has contributes to over 500 community food gardens, greener suburbs and environmental projects, and has distributed over 1.5 million trees to disadvantaged communities living in barren and degraded areas.
Trees for Homes provides trees, training, some employment and awareness for residents in low cost housing developments and aids climate change mitigation through carbon storage.

6.8. Urban Sector Network (USN)

The Urban Sector Network (USN) is a network of NGOs working towards ensuring that disadvantaged people can access and utilise an equitable share of national resources. Programmes to do this include training and capacity building, engaging with housing stakeholders around the administration and planning issues and the facilitation and management of housing projects.

7. Energy savings potential

When looking into energy efficiency in residential housing, the ultimate aim is a reduction in the amount of energy used to keep the house at comfort level. This chapter looks into the potential energy savings achievable by implementing an energy efficient housing programme.

7.1. Current energy use for space heating

In South Africa several studies have been completed looking into the energy use of households. Unfortunately these studies are either outdated, fragmented, not distinguishing between the end use of the fuel used or incomplete.
The most recent effort in this regard was the USAID funded study "Environmentally sound energy efficient low-cost housing for healthier, brighter and wealthier households, municipalities and nation, evaluation of performance and affordability of intervention technologies" (Irurah 2000), which also recognises the difficulty of getting accurate information on the current fuel use. The following tables are adapted from (Irurah 2000)

	area 1 (Cape Town)	*area 2 (Johannesburg)*	*area 3 (Durban)*
Electricity (kWh)	387.8	358.4	387.1
Coal (kg)	371.7	743.4	247.8
Wood (kg)	0	0	0
Paraffin (l)	49.2	21.0	22.8
Gas (kg)	6.9	2.0	2.7

Table 8 Annual consumption for space heating by region and fuel. Source: (Winkler, Spalding-Fecher et al. 2000)

	area 1 (Cape Town)	*area 2 (Johannesburg)*	*area 3 (Durban)*
Electricity	75	69	54
Coal	2	5	3
Wood	0	0	0
Paraffin	19	23	38
Gas	2	1	0

Table 9 Share of houses using fuel for space heating by province (in %). Please note that the columns do not add up to 100%, as per original source. Source: (Winkler, Spalding-Fecher et al. 2000)

Other relevant sources of information on household energy use are (Afrane-Okese 1995) and (Simmonds and Mannon 1996), from which the following tables originate:

Energy intensities for end-use of electricity in low-income formal houses: (Afrane-Okese 1995)

	kWh/month	GJ/year
temperate climate	164.2	7.1
hot-humid climate	154.7	6.7
hot-dry climate	181.1	7.8

Table 10 Electrical space heating

	formal electrified	formal non-electrified	planned informal	unplanned informal
Gauteng	3358	5457	5668	4199
Durban / Pitermaritzburg	1935	3156	2665	2069
Cape Town	1942	1561	1461	1392
Port Elizabeth / East London	1252	1098	1007	1013

Table 11 Average monthly household energy consumption (in delivered MJ) (Simmonds and Mannon 1996)

However, all the available information isn't sufficient to come to a good estimate of the current energy use for space heating in low-cost subsidy houses. In order to develop a good baseline to which possible interventions in the low cost housing segment can be evaluated, more accurate energy use data need to be collected. A full survey to collect this information will be conducted by the Department of Housing during the winter of 2003. In the 2002 winter a small pilot survey was executed to get a first indication of the magnitude of energy consumption. That survey covered 150 households in Gauteng and the Free State and focussed on RDP houses only (Klunne 2002). A summary of the results can be found in the following table.

<<<TO BE ADDED>>>	

Table 12 Results of the 2002 energy use survey on space haeting in RDP type of houses in Gauteng and Free State (Klunne 2002)

7.2. Possible interventions and their associated savings

As part of the current World Bank funded efforts to develop an energy efficient RDP housing programme Irurah (Irurah 2002) has done computer simulations on possible interventions and there benefits. This paragraph will discuss the results of that study in order to quantify possible energy savings as result of energy efficiency interventions in the low cost subsidy houses segment of the market.

In order to assess the potential for energy efficient housing the current standard for 30 m^2 RDP houses has been evaluated for energy use. Using computer modelling, several energy efficiency interventions have been simulated on their energy requirements.

7.2.1. Baseline

As a baseline for the intervention modelling a 30 m^2 RDP type house has been used. Such a house does typically consist of the following:

walls: 140 mm hollow concrete blocks with 5 mm of plaster on the outside,
roof: corrugated iron sheets,
ceiling: no ceiling, no ceiling insulation,
glazing: 6 mm clear glass, single glazing, loose hanging, no weatherisation, metal-framing,
floor: 100 mm in-situ concrete surface bed of 75 mm concrete and 25 mm screed,
doors: 12 mm timber door, loose hanging, no weatherisation.

The house is simulated to be stand-alone and not orientated towards north (an angle of 45º towards north east is assumed). The size of the house is 30 m^2, with a volume 70 m^3. An impression of the house is given in Figure 21.

The simulation with the simulation software "Energy Toolbox" gives the required energy for space heating for the fourteen distinguished zones. The energy requirements range from a low 5600 MJ/year in the Natal coastal area to a maximum of 16000 MJ/year in the Free State. Please note that the energy requirements to keep the house at a pre-set comfort level are calculated. The amount of energy calculated is the demand for energy and not necessary the actual amount of energy being used.

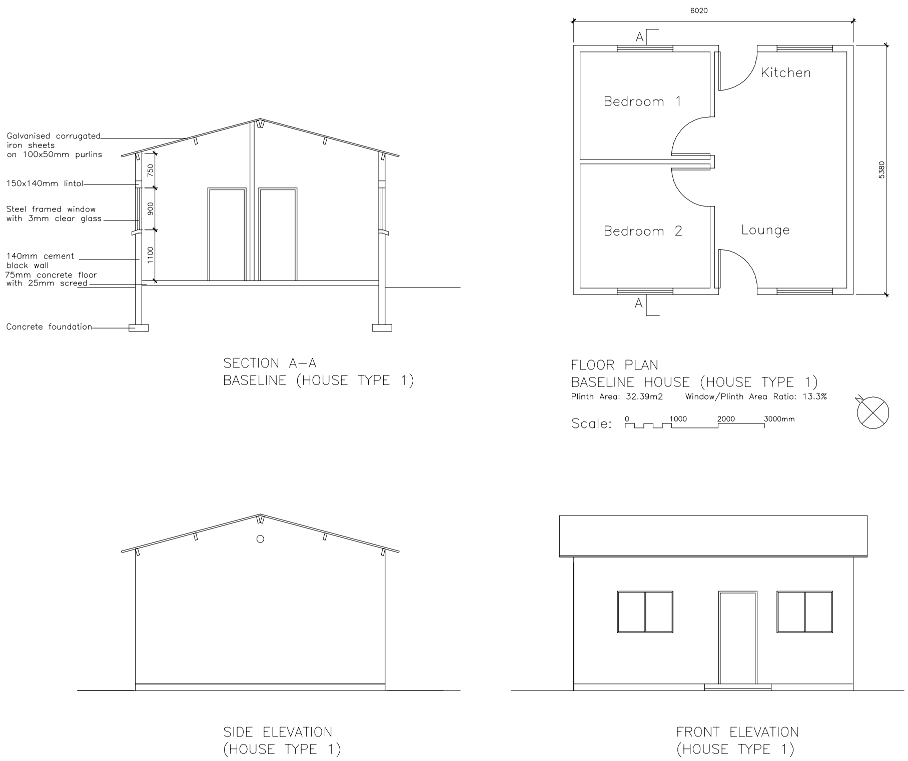

Figure 21 Baseline 30 m^2 RDP house (Irurah 2000).

7.2.2. Interventions

With the simulation software several possible interventions were simulated on their heating requirements. Single interventions were simulated as well as packages with combinations of interventions were evaluated.

The following interventions and combinations of them were considered:

Cavity walls:
- inner- and outer-skin both concrete blocks and 25 mm air cavity
- outer-skin concrete blocks, inner-skin gypsum board, with and without polystyrene insulation
- concrete blocks wall with polystyrene and plaster on the outside

Ceilings:
- gypsumboard ceiling with insulation
- gypsumboard ceiling without insulation

Other interventions:
- orientation
- concrete slab
- weatherisation
- double glazing
- row house single storey
- multi-storey construction detached

These interventions were applied to the standard RDP house of 30 m^2, as well as to medium density walk-ups of 3 floors with 4 units each and are described in detail in (Irurah 2002).

7.2.3. Heating requirements simulations

The modelling software evaluates the indoor temperature of the house when the interventions are implemented. Based on the outside temperature pattern, the inside temperature will be calculated and the amount of energy needed to get the house at comfort level is calculated.
To distinguish between the different climatic characteristics of areas within South Africa, the following zones are considered:

- Eastern Cape coastal
- Eastern Cape interior
- Natal coastal
- Natal interior
- Western Cape coastal
- Western Cape interior
- Northern Cape North
- Northern Cape South
- Free State
- North West
- Gauteng
- Mpumalanga highveld
- Mpumalanga lowveld
- Northern province

For every zone, one or two towns with known climatic conditions are selected for energy requirement simulations.

7.2.4. Assumptions

All the house designs were simulated with a similar set of assumptions concerning the use of the house and the characteristics of the materials.

In the simulations the default settings of the Building Toolbox software for the behaviour of the people in the house were used. These included a number of users of 6 persons during the night and a varying number of people during the day. For the level of activity and clothing, default values were used (1.0 clo and 1.2 met).

The designs were simulated for the heating season only and the amount of energy required to keep the house at comfort level was calculated based on the climatic data in the software's database. The energy requirements are provided in kWh equivalent, but were converted into units of the fuels in the actual energy mix used in the region.

The amount of energy required to keep the house at comfort level (for 90% of the users) was compared with the energy requirements of the baseline house and converted into carbon emissions avoided. The costs of the interventions are based on Bureau for Economic Research (2001) Building and construction, vol 16, no 2

7.2.5. Simulation results

For all the different interventions and packages of interventions, the heating requirement of the houses were simulated. This amount of energy is compared with the energy requirement of the baseline house and the difference is assumed to be the energy saving potential of the intervention. It is assumed that the heating value of this saving would have been achieved using the same energy mix as the baseline is using. From the combination of heat requirement reduction and the energy mix, the avoided carbon emissions per year per house were calculated. These avoided emissions are discounted over a time horizon of 10 years and a discount rate of 10% to the net present value.

Based on the assumptions as summarised in Table 13, a ranking of the most promising interventions was compiled.

electricity	287.43	kg CO_2/GJ delivered
coal	104.01	kg CO_2/GJ
wood	0	kg CO_2/GJ
paraffin	71.5	kg CO_2/GJ
gas	56.1	kg CO_2/GJ

Table 13 Climate change emission factors:

The costs of the interventions is as follows:

north orientation	0
ceiling airspace	1350
25 mm polystyrene insulation ceiling	600
concrete slab	630
weatherisation	300
double glazing	11400
double skin wall 2* concrete blocks	5600
double skin wall concrete blocks & gypsum board	3024
double skin wall concrete blocks, polystyrene & gypsum	4144
row house single storey	-700
storey construction detached	1216

Table 14 Cost of the interventions (in Rand per house)

Based on these assumptions (Irurah 2002) prioritises the interventions as given in Table 15

stand alone units	**medium density**
orientation	orientation
weatherisation	weatherisation
ceiling with insulation	ceiling with insulation on the top floor
	wall insulation on outer walls

Table 15 Proposed interventions

8. Barriers for the mainstreaming of energy efficient low cost housing

Several initiatives on energy efficiency in low cost housing segment have seen the light, but non succeeded in changing the mind set and make energy efficiency common practise. In order to identify the barriers for the uptake of energy efficiency the Department of Housing did a barrier analysis (DoH 2002b). The main barriers identified from that study are displayed in Table 16

Affordability	Cost of interventions
	Household incomes
	Levels of fuel-use
	Cost-benefit allocation
Awareness	Government (all spheres)
	Professionals
	Housing developers
	Housing consumers
Capacity	National and Provincial Government
	Climate Change and GEF offices
	Local Government
	Housing developers
	NGO and CBO sectors
Cost of energy	ESKOM
	Local Government
	Consumers
Access to finance	Bridging finance
	Finance for households
	Payback timeframes
Regulation	Government (all spheres)

Table 16 Barriers towards the mainstreaming of energy efficient low-cost housing (DoH 2002b)

From this analysis, as well as discussions with people and organisations involved it becomes very clear that the cost of the interventions is way beyond the affordability levels of the homeowners. To address this situation the prizes of the interventions need to be reduced dramatically. Industry however is not able to reduce the costs, as volumes are low at the moment. A possible programme to main stream energy efficiency in low-cost housing needs to break this vicious circle.

9. Conclusions

In last decade a large number of projects and initiatives on energy efficiency in low cost housing were initiated in South Africa. All with the very best intentions and most of them with good results as well. However, all these efforts did not result in a change in construction practices: energy efficiency in the low-cost housing sector is NOT common practise as yet. The concepts have been tested in the country, local knowledge to implement energy efficiency is available, but market volumes are not achievable at this moment to reduce the price of interventions to overcome the main barrier for main streaming energy efficient housing.

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Appendix 1: persons met

During the course of the missions of this assignment the following persons (in alphabetical order) were met:

- Alastair Rendall, ARG Design
- André van der Walt, Gauteng Department of Housing
- Andrew Mathews, TEMM International (Pty) Ltd
- Andries Gildenhaus, ESKOM Demand Side Management
- Annie Sugrue, Midrand EcoCity
- Anton Arendse, Department of Housing
- Baukje Hazeboek, TU Delft
- Bertus Scholtz, provincial Department of Housing, Free State
- Bill Cowan, Energy & Development Research Centre University of Cape Town
- Chris de Wet, De Leeuw South AFrica
- Chris Grobbelaar, Department of Minerals and Energy
- Chrisna du Plessis, CSIR
- Christell Beyers, IIEC
- Cliff Thompson, Nare Construction
- Colin de Kock, Gauteng Master Builders Association
- Corné de Leeuw, DelQS
- Daniel Iruha, University of Witwatersrand
- Dieter Holm, University of Pretoria
- Don MacLeod, Agrement
- Duma Moses Nkosi, member of parliament (parliamentary committee on minerals and energy)
- E.H. Mathews, TEMM International
- Erica de Lange, Palmer Development Consultants
- Frank Hansen, Department of Minerals and Energy
- Fred Wagenaar, NHBRC National Home Builders Registration Council
- Gerhard de Leeuw, DelQS
- Gita Goven, ARG Design
- Glynn Morris, AGAMA energy
- Goldius Russel Baloyi, SEED
- Hans Schefferlie, AAAMSA
- Hans-Gërd Hūhn, GTZ Pretoria
- Harald Winkler, Energy & Development Research Centre University of Cape Town
- Harmen Oostra, SHF
- Henk Kaan, ECN
- Izak Kotzé, Department of Minerals and Energy
- Izak van Gass, ESKOM TSI
- Jackie Friedenthal, DANIDA
- Jan Reimer, DANIDA
- Jan van der Mescht, Gauteng Department of Housing
- Jeremy Gibberd, CSIR / Boutek
- Johan Streuderst, DFS
- Johan Wallis, Department of Housing
- Joop van Wamelen, Agrement
- Lilia A. Abron, PEER consultants
- M.M. Mokoena, Free State Department of Housing
- Madeleine Costanza, IIEC
- Marius Willemse, RAPS
- Mark Borchers, Energy & Development Group
- Mark Napier, CSIR / Boutek
- Mark Swilling, Spier Leadership Institute
- Marlett Wentzel, Palmer Development Consultants
- Martin de Wit, CSIR / Environmentek
- Melissa Whitehead, IIEC
- Mike Bolton, CSIR / Boutek
- Mike Morkel, Settlement Dynamics
- Mike Myers, TIASA

- Monty Narsoo, Department of Housing
- MZ Nxumalo, Department of Housing
- Mziwonka Dlabantu, Department of Housing
- Neil Oliver, CSIR / Boutek
- Nelisiwe Mugabana, Department of Minerals and Energy
- Odette Croften, SHF
- Pako Petlane, Griniker-LTA
- Palesa Tsita, Department of Housing
- Pamela Sekhonyana, Department of Housing
- Peter van Duyn, EPSASA
- Pierre Rousseau, Griniker-LTA Building
- Qasim Kalla, Gauteng Department of Housing
- Radiphol Masike, provincial Department of Housing, Free State
- Samson Moraba, NHFC
- Sarah Ward, Sustainable Energy Africa
- Sheron Lewis, Department of Housing
- Stef Raubenheimer, SouthSouthNorth
- Steinar Hagen, Norad
- Steve Szewczuk, CSIR / MTek
- Steve Thorne, SouthSouthNorth
- Sue Bannister, consultant
- Svend Byrial Poulsen, Svend Byrial Poulsen Consult
- Thando Miti, Maluleke, Luthuli & Associates
- Themba Maluleke, Luthuli & Associates
- Theuns Knoetze, Agrement
- Tony van Engelen, Planet
- Tor Øivind Tanum, Norad
- Torsten Malmdorf, DANCED
- Yasmin Coovadia, Gauteng Department of Housing