Energy Efficiency in the Low Income Homes of South Africa

Judith Sykes

September 2009

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ISDA Project

This paper is part of the project International Support for Domestic Action (ISDA). Case studies from five developing countries assess the barriers and drivers of actions that shift individual sectors onto low-carbon growth paths. Five cross-cutting papers then explore how international financial mechanisms, technology cooperation, intellectual property aspects, and suitable monitoring and reporting arrangements can enhance the scale, scope and speed of their implementation. The project is coordinated by Karsten Neuhoff, University of Cambridge; individual reports are available at http://climatestrategies.org/our-reports/category/43.html.

Acknowledgements

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Executive Summary

Despite real and tangible benefits of energy efficient housing to low income families and emerging policy support, donor-funded pilot projects incorporating a range of passive thermal improvements and solar water heaters have failed to lead to wide scale implementation. In this paper, barriers and drivers to implementation of projects are evaluated through interviews and site visits to exemplar projects. Financing was found to be a significant obstacle, in addition to a series of systematic barriers. Proposals to strengthen domestic policy are discussed, including policies to build capacity, develop local technologies and implement performance standards. Two types of international support mechanisms for domestic policies, the CDM and Direct Support, are evaluated. Results indicated that support linked to carbon payments for emissions reductions do not provide a sustainable model for these types of projects; where carbon savings are small and dispersed. Mechanisms that provide upfront finance, support poverty alleviation, reduce growth of emissions and seek to remove systematic barriers are proposed as a preferable alternative.

Programme of Actions

The government of South Africa operates a subsidised housing scheme for low income families and has committed to the construction of 300,000 subsidy homes per annum. Studies show that relatively simple interventions can have significant impact on the thermal performance of a standard subsidy house. Passive measures of; orientation, correct window sizing, and insulation can eliminate the need for space heating (USAID 2000). Solar water heaters offer a further way of reducing use of dirty fuels for hot water in cooking and washing. There is also scope to retrofit existing housing, in particular with ceiling insulation and solar water heaters. The combination of these interventions on a new build project has estimated savings of 70% on fuel costs (Winkler 2008). The wider societal benefits of a healthy, more prosperous population and reduced emissions from burning of fossil fuels are also recognised.

Needs: Drivers and Barriers

Through an evaluation of case study projects and interviews with those involved in the delivery of housing and energy efficiency policy, barriers and drivers to mass deployment of energy efficient measures in low income homes have been identified.

The interviews reveal an absence of policy support for energy efficient low income housing and a huge disconnect between policy development and capacity to implement. Insufficient levels of funding and institutional capacity were significant issues found to have an impact on the project process at each phase of implementation. Interviewees described problems with a lack of knowledge amongst policy makers about the wider social benefits of energy efficiency in low income housing, a bureaucratic policy implementation process that protects business as usual approaches, and an inability to make decisions at both national and local levels of governance.

Lack of knowledge from general awareness of the possibilities of energy efficient design to the detail of how to deliver and absence of performance standards were also found to inhibit the design phase of
INTERNATIONAL SUPPORT FOR DOMESTIC ACTION

project delivery. Poor understanding about building performance and failure to monitor during project commissioning and operation, is further preventing the dissemination of knowledge and experience with energy efficient housing designs for South Africa.

Procurement of technologies suitable for the South African climate was highlighted as a key challenge to overcome. Imported solar water heaters, for example, were expensive and found to perform poorly or were not configured to meet the needs of the homeowner.

Principal drivers to project implementation were identified by interviewees as donor funding and the role of ‘champions’ either within the community, or project agents who would be able to successfully move projects forward, despite the severity and number of barriers that had to be overcome. Desirable character traits of such local champions included faith, perseverance, arrogance and ability to build relationships. Projects which harnessed community support were also perceived as being able to overcome any potential misunderstandings from homeowners.

**Key Barrier diagram**

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<th>Key Barriers</th>
<th>Phase of project implementation</th>
<th>Commissioning Operation</th>
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<td>Inception</td>
<td>Planning &amp; Design</td>
</tr>
<tr>
<td>Finance</td>
<td>Housing subsidy not sufficient</td>
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<td>Institutional Capacity</td>
<td>Gap between written policy and implementation</td>
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<td>Skills and Knowledge</td>
<td>Lack of knowledge about benefits of EE</td>
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<td>Lack of building standard for EE</td>
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**Options for Addressing Barriers**

In response to this assessment, recommendations have been made to strengthen national support for thermally improved subsidy housing. Options for this include: the introduction of an energy performance standard for low income housing, building the capacity of institutions and practitioners, and policies to stimulate the delivery of innovative solutions to energy efficient housing. Enabling policies should also strive to harness the potential that exists within those communities that stand to benefit from the interventions both in terms of driving and delivering improvements.
International mechanisms for supporting domestic action are also evaluated. Financing through the Clean Development Mechanism was shown to be able to provide only part of the funding required. This is because of the low carbon price and small dispersed savings relative to the required initial capital investment. The narrow focus of the CDM on financial support also fails to address broader systematic barriers identified.

Direct support, either bilateral or multilateral, for energy efficient housing is proposed as an alternative to the CDM, providing accessible, upfront and comprehensive support to government institutions, developers and homeowners. Not only seeking to provide capital finance through grants, but also targeted support for domestic needs (e.g. in the form of capacity building). Support can be linked to broader mitigation actions relating to the built environment, including spatial planning. It is anticipated that such mechanisms could be one way of supporting Nationally Appropriate Mitigation Actions proposed by developing nations under long-term cooperative frameworks for climate change mitigation.

Options to use existing micro-financing and insurance markets are proposed, with the homeowner and local community at the heart of driving and implementing solutions. It is hoped that this option would contribute to innovative approaches of international policy solutions. The extent to which contribution to capital investment can be made by homeowners is also evaluated.

Key Action diagram

<table>
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**Suitable Indicators**

A series of indicators have been recommended for monitoring of policy implementation. Key output indicators include: the performance of new housing by region, the energy burden in low income households, residential carbon emissions and GDP of the lower income quintile. Indicators have been selected to assist with policy refinement, e.g. strengthening performance codes as the housing market responds to the provisions of the code. It is proposed that development of policy indicators and associated monitoring and verification be carried out at the national level.
1. Introduction

Since the end of the apartheid era, South Africa has experienced strong economic growth and rapid urbanisation. As a result, South Africa’s cities have developed into sprawling areas of low density housing interlaced with growing numbers of shack dwellings. Population growth and decreasing household sizes place further pressure on the need for housing expansion policies.

Although 2.7 million homes have been constructed since 1994, the government estimates that approximately 1.8 million families live in informal settlements and has set a policy objective of eradicating all of these settlements by 2014 (PRSA 2008). To meet the government target will require some 300,000 new homes to be constructed per year. If all housing need were satisfied, affordable homes would constitute approximately one third of all housing (Fast Facts 2008).

South Africa’s economy is highly energy intensive, a function of heavy industries such as mining, inefficient electricity supply and sprawling urban areas. Whilst industry is the largest in terms of sector energy consumption, the two fastest growing sectors are transport and the built environment. The largest 16 urban environments in South Africa occupy less than 3% of the land yet consume more than 50% of energy supplied (Borchers 2008).

![Figure 1 Proportion of energy consumption by sector in South Africa 2006](Source: DME 2006)

Despite a mass electrification scheme and access to subsidised electricity, South Africa’s urban poor continue to choose to use more affordable dirtier fuels such as biomass, paraffin and coal burnt directly in stoves or imbawulas. Poor thermal performance of subsidy housing and shack dwellings reinforces decisions to use these fuel types. Low income families spend between 12% and 20% of their total income on fuel, compared with an energy burden of just 2% in high income homes (CURES 2009, Hildebrand 2008).

Improving the standard of subsidy housing will have huge direct benefits to health and prosperity of home owners. The introduction of efficiency measures will have broader economic benefits to society and bring about climate co-benefits in the form of a lower carbon emissions growth trajectory. Despite the real and tangible benefits and emerging policy support, donor-funded pilot projects incorporating a range of passive thermal improvements and solar water heaters have failed to lead to wide-scale implementation.

Through an evaluation of case study projects, and interviews with those involved in the delivery of housing and energy efficiency policy, this research explores barriers and drivers to mass deployment of energy efficient measures in low income homes. Interviews were conducted with representatives from community based organisations, NGOs, universities, national and local government as well as consultants and developers. Interviewees were selected to provide perspectives across the spectrum of people involved in low income housing delivery and energy efficiency policy. Eight site visits were also conducted including to pilot projects, a business as usual development and an informal settlement to provide context of broader development priorities.

In response to the analysis, additional policy support for implementation of improved housing is proposed and the role of international mechanisms to support such domestic policies are evaluated.
2. Thermal Improvements to Low Income Homes

A government subsidy to cover the construction of a 40m² home is available for families with incomes of less than R3,500 per month. The majority of subsidy homes are built directly by government contractors. However, the Peoples Housing Process (PHP) offers a way for homeowners to construct their own homes (DH 2009).

Studies show that relatively simple interventions can have significant impact on the thermal performance of a standard subsidy house. Passive measures of orientation, correct window sizing, overhangs and insulation can eliminate the need for space heating (USAID 2000). Solar Water Heaters (SWHs) offer a further way of reducing the use of dirty fuels for hot water in cooking and washing, and importantly also offer an improved hot water service to low income households. There is also scope to retrofit existing housing, in particular with ceiling insulation and solar water heaters. The combination of these interventions on a new build project has estimated savings of 70% on fuel costs (Winkler 2008). The wider societal benefits of a healthy, more prosperous population and reduced emissions from burning of fossil fuels are recognised, but more difficult to quantify. Energy efficiency policy also contributes to savings in capital investment into additional electrical generation and distribution capacity.

![Diagram](image)

Figure 2. Interventions to improve the energy performance of basic subsidy house

A number of projects that have incorporated some or all of the improvements described have been implemented in South Africa. However, most are considered pilot projects and hence tend to be small in scale. As a proportion of total housing constructed since 1994, these projects amount to less than 1% (Klune 2002, PRSA 2008).

Figure 3 shows incremental costs with associated carbon savings for additional measures to the basic subsidy house and for a retrofit of ceilings and solar water heaters to existing homes.
The actual CO₂ savings are small, less than 1 ton per annum in both the retrofit and new build cases. Implemented at scale however, savings are more significant. Also shown are the CO₂ savings calculated using the Suppressed Demand methodology, developed by the NGO South South North and the University of Cape Town, to establish the baseline for carbon emission reductions (CER's) on the Gold Standard registered Kuyasa Housing project in Cape Town. The methodology identifies a baseline that would occur if demand had not been suppressed by barriers such as poverty. As such the Suppressed Demand methodology is a way of attracting greater CERs, and hence revenues, to leapfrog to clean development without allowing fuel consumption to get ‘dirty’ first.

The primary reason for supporting such projects is not for their immediate carbon emission reductions rather that they support development and poverty alleviation that is decoupled from the use of fossil fuels. These projects have a climate co-benefit in the form of reduced growth in carbon emissions. Hence in this analysis the suppressed demand figures are used to indirectly determine the benefit in terms of reduced growth in CO₂ emissions.

The incremental costs and associated carbon savings for a programme of rolling out thermal improvements to subsidy housing at a national scale are set out in Table 1. Initial phases of policy implementation typically incorporate a period for developing pilot projects. However the critical issue for South Africa is the step change from the pilot projects that have been developed over the last decade or so, to a mass roll out. This position is reflected in the table below.
Table 1. Capital costs of implementation and CO₂ benefit

3. Barriers and Drivers of Implementation

The following assessment of barriers and drivers was established through interviews with 26 stakeholders involved with the delivery of low income housing and energy efficiency, including NGOs, community based NGOs, local and national government as well as consultants, developers, research institutions and the national utility Eskom. In addition, site visits were made to 8 housing developments comprising predominately exemplar energy efficiency housing projects but also a business as usual (BAU) development and an informal housing settlement to establish the broader context of housing need.

A semi-structured approach to interviews was adopted, facilitated by an assessment tool as shown in Appendix 1. The assessment tool was developed specifically to allow interviewees to focus on elements of the project process based on their experience and draw out where along the project process barriers occurred or specific support drove the project forward. A summary of this evaluation is provided below.

3.1 Financial Barriers

All groups interviewed identified lack of funding as the principal barrier to implementation of energy efficient homes. Specifically, the National Housing Subsidy was described as only being able to provide the ‘bare bones’ of a home under the government standard. Several interviewees questioned why the government could not increase the subsidy, and this was linked to institutional capacity and lack of interdisciplinary thinking. Over half those interviewed raised cash flow during procurement and construction as a significant issue. Though poor cash flow affects all low income housing projects, bulk BAU contractors are perhaps more able to sustain erratic flow of funds. However, projects implementing energy efficiency measures and housing under the PHP were found to be much more susceptible to funding gaps. Delays in receipt of government funding impacted on the incomes of those employed on projects and the ability to fund subsequent phases of projects. Contractors are also affected by issues of funding. Low profit margins result in compromises on quality of workmanship and inability to offer anything other than bulk BAU.
Figure 4. Plot of barriers to implementation of energy efficiency interventions in low income housing throughout the project process

### 3.2 Institutional capacity

Lack of institutional capacity was also identified by the majority of interviewees as a major barrier at the project inception stage. The institutions which referred to in the interviews included both national and municipal governments. When asked to define the current inadequacies of institutional capacity, interviewees described a lack of knowledge about the wider social benefits of energy efficiency in low income housing, a bureaucratic policy process that protects BAU, and the inability of government officials to make decisions.

Linked with these criticisms was the observation that a history of failed projects and technologies further incapacitated institutions for fear of repeated failures. This led to a conservative interpretation of policy and an excessive reliance on procedural guidelines to avoid adverse scrutiny. Furthermore, several consultants and researchers proposed the idea that institutions currently lack interdisciplinary linkages, thus preventing them from harnessing learning experiences and their associated benefits across departments and sectors.

Regional town planners were said to lack sufficient knowledge of energy efficiency measures. This resulted in delays in the planning system where schemes differed from the standard subsidised housing due to the refusal of applications that included designs that were not recognisable. The time delay for gaining approvals often had knock-on consequences (e.g. causing friction within the community). Town planners were also found to lack the resources to be able to engage with energy efficient projects, both in terms of the provision of additional community liaisons to engage with local stakeholders and to accommodate learning of municipal project managers, required to develop projects that are not BAU. Also the role of government procurement strategies for the delivery of housing was cited as being overly complex and protecting relatively inefficient BAU practices over goals of sustainable development.
During the commissioning of projects, corruption and the competence of building inspectors were identified as further barriers to ensuring that energy efficient housing met national housing standards. Several interviewees claimed that building inspectors produced fraudulent certificates in exchange for ‘backhanders’. Inspectors were also not trained to be able to identify whether the constructed details met the specifications for passive design standards. Mistaking building insulation for packaging material and ordering its removal was cited as one example.

### 3.3 Broader Skills and Training

Lack of knowledge was also found to inhibit the design phase of project delivery. Consultants, NGOs and researchers described how engineers were not trained in the design of energy efficient housing and lacked the willingness to embrace new techniques and technologies. Poor understanding about building performance, failure to monitor the commissioning and operational phases of a building’s life is further preventing the dissemination of knowledge on energy efficient designs for South Africa. In the absence of joined-up research on the optimal design and dissemination of information, interviewees observed that it is simply easier for designers and contractors to do what has been done before. A lack of performance standards was also cited as a barrier to design and implementation of energy efficient housing. Despite the launch of a voluntary performance code, South African National Standard (SANS) 204, it was found not to support low income housing, only providing a minimum performance requirement. Even though the Standard is due to become a mandatory requirement for housing, the code had no mechanisms to ensure its enforcement. Government representatives stated that a supplementary standard for low income housing was being discussed but did not suggest a firm date when it will be introduced. Government policymakers also acknowledged that without additional measures to overcome barriers further along the project process such as tackling the role of building inspectors and compliance monitoring, such standards would fail to achieve their intent.

Poor quality of workmanship is known to be an issue throughout low cost housing developments. Where passive design techniques have been used, poorly constructed elements undermine housing performance.

Procurement of technologies suitable for the South African climate was highlighted as a challenge by four interviewees. Imported solar water heaters were found to perform poorly; producing water that was either too hot or too tepid, or were not configured to meet the needs of the homeowner and were too expensive. The time to process approvals for alternative solar water heaters through the South African Standards Bureau (SABS) inhibits switching to new technologies. Products that are over-specified for the South African climate were given as another example of a challenge for technology procurement.

### 3.4 Drivers

Over half of interviewees identified the role of champions as drivers of the successful implementation of energy efficiency projects. These champions were described as committed individuals from within communities, developers and NGOs. Character traits identified with this role were faith, empowerment, compassion, perseverance, arrogance and ability to build relationships. Champions have already accomplished a huge amount in the face of a series of problems presented throughout pilot projects’ implementation. However, despite strong leadership, pilot projects have failed to meet expectations at the project outset. Programme aspirations have not been met, the number of homes delivered is much reduced and issues of quality of build persist. Furthermore, these projects failed to achieve the wider aspirations of champions; to deliver sustainable models for implementation at scale.

All of the projects incorporating thermal improvements were supported by external donor funding, from minimal levels to cover additional staffing costs, to top-up funding for insulation, ceilings and solar water heaters. Carbon financing was also identified as a potential source of additional funding.

Community workshops and the roles of NGOs supporting training and development were also identified as key to overcoming barriers in the planning and design phases of project implementation.
Coupled with workshops, demonstration projects also helped foster understanding of the benefits of energy efficiency housing, creating demand from homeowners for interventions. This was most noticeable in two of the exemplar projects, Kuyasa and Witsand near Cape Town.

![Figure 5](image.png)

**Figure 5** Plot of drivers to implementation of energy efficiency interventions in low income housing throughout the project process

4. Domestic Policy Action

Whilst levels of funding are a significant obstacle to implementation of energy efficient measures in low income housing, the analysis reveals a range of institutional and capacity related barriers which have additional impacts at each phase of project implementation.

The following section explores how domestic policy can be strengthened to promote successful delivery of improved housing in the context of broader sustainable development goals. The policy focus is on capacity building, performance standard, appropriate technologies and financial support.

4.1 Establishing a Performance Standard

The proposed SANS 204 for subsidy housing will be performance based, (ie kWh/m²) with minimum performance for energy consumption depending on regional variation (Valt 2009). It is anticipated that the National Building Code produced by the NHBRC will be amended to incorporate techniques for achieving this standard (Getzler 2009). Interviewees generally supported a performance standard rather than adoption of specific interventions since there is greater flexibility in the method of achieving the standard, which will depend on site context. However there are three principal issues with SANS 204 for low income housing. Firstly the process and time required to implement the code. The second issue is one of compliance. The interviews highlighted how current standards were not enforced, and high likelihood that SANS 204 will also fail. Finally, the standard is only a minimum requirement, designed to be achievable with only the addition of an insulated ceiling. As such there is scope to achieve a much higher performance level in low income housing.
There are three further policy recommendations to support the implementation of a performance standard. Firstly, that a voluntary ‘best practice’ standard is promoted as a measure of incremental improvement in performance above SANS. In the commercial sector, incentives to achieve such standards are driven by the need to differentiate and corporate social responsibility. For low income housing this could be linked to international support. This could be further adopted in other developing countries to drive improvements in low income housing, perhaps coordinated by UNHABITAT or NGOs operating in the low income housing sector such as ‘Fed Up’. Secondly, both the SANS standard, and any recognition of performance over SANS, will require a system of compliance monitoring and certification, if it is to be implemented in any meaningful way. Inspection would assure that constructed buildings meet match design drawings coupled with performance testing on a sample of homes. This would require training of ‘inspectors’ and a mechanism to prevent corruption of building inspectors, perhaps through status building or whistle blowing rewards. Monitoring would further provide data to inform design and a base for incremental increases to the performance standard.

Implementation of a performance standard is therefore not only a reward for best practice and supporting minimum requirements for energy use in homes. Implementation has broader benefits as a vehicle to raise awareness and stimulate education and skills training. Further, compliance monitoring will develop improved knowledge on building performance and deliver incremental improvements to building designs.

4.2 Capacity Building

A serious and daunting programme of capacity building is required to address failures in capacity to implement energy efficiency at each phase of the project process.

Firstly there is a need within municipalities and governments to address the gap between written policy and implementation. In part this can be achieved through the development of indicators of policy success as described further below. There is also a requirement to recognise the societal benefits of good quality housing and link this to other development priorities. This can be addressed through education but would also require arrangement of institutional organisations to allow for interdepartmental cooperation.

However, there is a more fundamental need to address the confidence and ability of the government to pursue alternative development paths. At a municipality level, Cape Town appears to be leading the way with the adoption of a number of environmental policies supported by NGOs such as Dutch funded Sustainable Energy Africa. Cape Town is also currently developing its own system of indicators for monitoring success (Ward 2009). Interviews with central government highlighted the need for a similar programme of support in the area of policy implementation.

Further along the project process is the requirement to develop proficiency in regional planners, engineers, building inspectors, and contractors. A series of vocational qualifications should be established, targeted at increasing skills levels in each of these groups. Access to construction skills training to local community beneficiaries should also be facilitated. This could be linked to the Green Skills initiative recently announced by the South African government as part of its economic stimulus package.

4.3 Appropriate Technology and Local Industries

In response to the lack of locally available technology suitable for South Africa, a suite of policy inputs are proposed, in particular to address the role of SWHs. These were identified by various interviewees as being inappropriate for low income homes; performing poorly, were too costly and where alternatives were proposed, the duration for approval through the South African Bureau of Standards (SABS) was too long. Yet given the solar resource in South Africa, there is an opportunity to further reduce electricity bills by heating water for washing and cooking through solar thermal heating. Moreover, SWHs will increase the provision of hot water services provided to low income families. The policies proposed here are anchored on developing technologies suitable for South Africa and
generating local industries to deliver them. The first priority would be to establish a performance
specification in consultation with homeowners and the SABS. The second element would be a fiscal
stimulus through a grant or subsidy to develop prototypes for market. These could be coordinated
through a body such as the National Energy Efficiency Agency and capped in number, issued to the
most promising proposals. Successful prototypes would be fast tracked through the SABS to gain
speedy access to market.

The interviewees identified the issue of reluctance to trial alternative materials and construction
techniques and a tendency towards an easier path of bulk business as usual. There is also an
observed ‘aspiration for a brick built house’. The National Home Builders Registration Council
(NHBRC) has developed innovation hubs and competitions to prototype alternative building
materials (Getzler 2009). Similar design and build competitions could be run for the low income
market with partnerships between local communities, contractors and designers, challenged to
deliver affordable homes. This is clearly linked to the goals of capacity building and community
participation.

5. International Support Mechanisms

Several possible sources of funding were identified by interviewees for providing the intervention
needed to reduce energy consumption. They included an increase in the housing subsidy, an energy
services model for solar water heaters and subsidies through the Demand Side Management
programme run by the utility monopoly Eskom. However these were found inaccessible and not able
to provide a sustainable level of funding.

Interviewees from institutional backgrounds all acknowledged that there was a role for international
support if provided in ways that are accessible. They should allow South Africa to develop its own
solutions and provide funding support that is not conditional on the purchase of overseas technologies
and services. In addition to funding, need for support in capacity building, policy implementation and
indeed gaining access to international assistance, were identified as priorities for international
support.

Two potential types of financial support are described and evaluated further below: the Clean
Development Mechanism and Direct Funding. Under Direct Funding, three alternative arrangements
are explored. Each involves similar financing implications but are targeted at different organisations
involved in the delivery of low income housing.

5.1 The Clean Development Mechanism (CDM)

The Mechanics of Support

The CDM is a mechanism by which Annex I parties can achieve their emission reduction targets
through cost effective investment in sustainable development within developing nations (UNFCC
2008). Developing countries sell emissions credits entitled ‘Certified Emissions Reductions’ (CER’s) to
those countries wishing to reduce their GHG emissions. The CERs must be ‘real and measurable’ with
long-term benefits to the mitigation of climate change and should be additional to any that would
occur in the absence of the certified project activity (The Kyoto Protocol 1998).
Programmatic CDM is based on the same principles as the project level mechanism but can be applied to a programme of activities rather than a single project. A single methodology can be approved for a series of projects delivered over a longer time frame, and projects can be added to the program as they are conceived (Carbon Trust 2008). As such, transaction costs can be distributed over a larger number of units. A single coordinating entity is required to establish the methodology and oversee the monitoring requirements and policy makers in South Africa are promoting the establishment of a National Sustainable Housing Framework (NSHF) in response to the opportunities created by programmatic CDM (Tyler 2008).

The Financial Model

The investment costs associated with the delivery of energy efficient housing under project and programmatic CDM have been estimated as set out in Table 2. The estimate is based on incremental costs for thermal improvements to 1 million new homes and 1 million retrofit projects. Carbon revenues are based on the Suppressed Demand CO$_2$ savings since this methodology has been approved by the CDM Executive Board. The table shows that whilst programmatic CDM has reduced transaction costs, the reduction is not significant since transaction costs based on UNFCCC estimates, are a small compared with capital costs. It is noted that interviewees placed more significance on transaction costs, probably due to the size of projects being implemented, but even if assuming lower transaction costs, Figure 7 shows that a carbon price of around €50/ton is required to provide payback periods that would attract private investment. The higher cost of private sector financing is represented by a discount rate of 12%, typical for private finance in South Africa (DEAT 2005). Furthermore, uncertainty about future carbon prices will increase private sector investment risk, likely to result in even higher discount rates or hedging strategies with additional associated costs.

If public sector financing were sought, represented through the application of a 5% discount rate, Figure 8 shows that either a carbon price of €40/ton would pay back within an 8 year period, or that greater revenues could be returned since cost of financing is reduced.
Table 2. Incremental costs and discounted carbon revenues

<table>
<thead>
<tr>
<th></th>
<th>Project CDM</th>
<th>Programmatic CDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost¹</td>
<td>€ 2.87b</td>
<td>€ 2.81b</td>
</tr>
<tr>
<td>Carbon price to pay back over 8 years</td>
<td>€ 5</td>
<td>€ 5</td>
</tr>
<tr>
<td>NPV of revenues for investor (discounted at 12%)</td>
<td>€ 2.92b</td>
<td>€ 2.92b</td>
</tr>
<tr>
<td>NPV of international support (discounted at 5%)</td>
<td>€ 3.70b</td>
<td>€ 3.70b</td>
</tr>
<tr>
<td>Additional financing cost</td>
<td>€ 0.78b</td>
<td>€ 0.78b</td>
</tr>
</tbody>
</table>

Figure 7. NPV of carbon revenues on 1 million new build and 1 million retrofit developments (assuming 12% discount rate)

Figure 8. NPV of carbon revenues on 1 million new build and 1 million retrofit developments (assuming 5% discount rate)

Evaluation of CDM

There is a growing body of literature describing the limitations of the CDM. The lack of take-up in Africa, difficulty in calculating the project performance, complexities of establishing a baseline methodology, the insufficient weight given to sustainable development goals, delays in completing registration, problems with identifying additionality, high transaction costs and low carbon prices have all been raised as barriers to fully realising the potential of CDM (Carbon Trust 2008, UNFCC

¹ Costs include capital, transaction, monitoring and maintenance. Transaction costs have been estimated based on UN figures (UNDP 2003) and are consistent with empirical evidence (Krey 20005)
Methodologies under the CDM are also technology focussed. Although the CDM does allow different measures to be ‘bundled’ together in one project, it is still the individual technology, not the overall performance of the building that is verified (UNEP 2008). For energy efficient homes where the interaction of different interventions is complex and highly dependent on occupant behaviour, these methodologies become difficult to apply. Hence a performance approach to projects would be more appropriate.

These issues have a greater impact on projects such as energy efficiency in buildings where carbon savings are small and dispersed over numerous individual projects. Projects with these characteristics have been referred to as the long tail of intervention potential (Hinostriza 2007). The case study of the Kuyasa project particularly exemplifies these issues and it is worth expanding on them further here.

**Figure 9. Kuyasa Retrofit Housing Project**

Kuyasa is an area of the Khayelitsha township in Cape Town. This project involves the retrofit of ceilings, insulation and solar water heaters onto existing 2,039 existing subsidy houses. The R30 million capital investment for the scheme has come from the Department of Environment and Transport (DEAT) and the City of Cape Town. The scheme is also registered as a Gold Standard project under the Clean Development Mechanism. To obtain the carbon revenues, the project has had to implement a comprehensive monitoring and verification scheme. Coupled with the installation and maintenance of the SWH, this has created a significant number of jobs.

Interviewees connected to the project all referred to the complexity and bureaucracy required to gain accreditation. This has two further impacts. Firstly, the CDM revenues were said to barely cover the transaction costs associated with setting up the CER’s. This was further compounded by the relatively low price of carbon and intensive requirements of monitoring and verification. Secondly and more generally speaking, the complex process and methodologies required to obtain CER’s limits accessibility to carbon revenues to those who are supported by knowledgeable NGOs or consultants.

Furthermore, given the timing of the revenues, a source for finance of the initial investment needs to sought. The analysis above shows that using private funding sources adds significant additional costs to project delivery, due to the additional costs carbon pricing risk creates for financing in the commercial market.

The narrow focus of CDM providing only financial support also fails to address other barriers identified in the analysis. Clearly the Kuyasa project has strong social and environmental attributes, as required by the Kyoto Protocol’s sustainable development criteria, however, the CDM has not delivered a sustainable economic model.

Even though contributions from carbon finance represent a small proportion of the capital costs, NGOs are prepared to negotiate the complex process required to achieve accreditation under the CDM. One interviewee stated ‘you use what you can get’ and another suggested ‘can we get a CDM credit’ is becoming embedded in to the psyche of development (Thorne, Annergarn 2009).

Moreover, the methodologies for establishing baselines against which reductions are certified are based on a hypothetical view of what would happen in the absence of that project occurring. Hence in many cases, and particularly where suppressed demand is utilised, there is no ‘real and measurable’
reduction, there is however an avoided future emission. The term Certified Emission Reduction is therefore unhelpful at best and at worst could actually result in an increase in carbon emissions. The CDM, under the Suppressed Demand Methodology, attributes the same value to an avoided emission as a reduced emission. This relationship allows developed nations to continue to pollute if they pay for a developing nation to avoid growth in pollution. The consequence of this is that whilst Annex I countries may achieve their targets with help through the CDM, the overarching aims of the Kyoto Protocol to reduce concentrations of atmospheric carbon may not be achieved and perversely could result in a growth of emissions.

The following mechanism proposed seeks to provide support that is tailored for the needs to enable specific mitigation actions.

### 5.2 Direct Support

The principal aims of Direct Support are to: provide comprehensive support to implementation of thermal improvements, ensure that support is accessible and provide upfront capital investment.

Three mechanisms that might provide direct support are discussed here. Support provided to government institutions, either at a local, provincial or national level, support to the developer and also to the homeowner. The financing arrangements are similar for all three approaches and these are subsequently considered.

**Framework Support for Government Institutions**

This mechanism is specifically aimed at providing a framework of support to government organisations as illustrated in Figure 10. Support would be accessible at a municipality, provincial or national level of governance to implement local or national policies that enable the delivery of energy efficient low cost housing.

![Figure 10. Mechanism for Framework Support to institutions](image)

The framework relies on institutions to identify their own specific needs and support can be tailored to align with domestic policy goals and priorities. For energy efficient housing, in addition to funding to increase housing subsidies, support would also include programmes for capacity building to support the implementation of domestic policies identified in Section 4.

A request for support could either be direct targeted towards an international climate cooperation institution, a partner country or could be registered by a coordinating agency under the UNFCCC
that would then facilitate a bilateral ‘match’. In the matching process, a mechanism for determining priorities for funding would need to be implemented. Objectives of the support and details of financial, technological and capacity building provision would be set out, agreed and verified through a Framework Document with clearly defined, measurable outcomes and indicators of success. Frameworks designed to support implementation of policies should ensure that they do not fail when funding and other forms of support cease to exist.

South Korea has similarly proposed that such support mechanisms be linked to the Nationally Appropriate Mitigation Actions (NAMAs) (ROK 2009). It is envisaged that developing nations volunteer NAMA plans which would then be supported by developed nations. The exact nature of the supporting mechanisms is currently under discussion and the subject of a draft text considering long-term cooperative action under the UNFCCC (UNFCCC 2009). The framework support described above explores one way such NAMA mechanisms might be implemented.

**Direct Project Support to Developers**

The principal aims of Direct Project Support are to provide comprehensive support to project implementation, ensure that support is accessible to all project developers and provide upfront capital investment to move projects forward.

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**Figure 11. Mechanisms for Direct Project Support**

Historically, direct funding in South Africa has come from overseas donors such as the Danish development agency DANIDA. However each development agency has different arrangements and measurements of success. Usually aligned with the goals of the donor agency rather than the host country. Direct Project Support would be defined based on identification of need by project developers. The mechanism illustrated in Figure 11 also provides the momentum and standardisation of methods of measurement not seen in donor funded projects and allows for provision of other forms of non-financial support to remove systematic barriers such as skills training, negotiation expertise and assistance in the establishment of monitoring systems.

In this model, qualification for funding would be linked to project performance, not the implementation of individual technology measures. Standardised methods of measurement and performance for low income housing can be developed to determine funding levels; playing a similar role to the standardised methodologies. This could be linked further to the voluntary exceedence of national performance standards as described in Section 4.1. The concept of additionality remains, whereby the demonstrable benefits of cleaner (relative to business as usual) development must be identified.
A number of potential organisations or consortiums could serve as the institution to provide the support. Mechanisms for Direct Support to developers differs from direct aid because of the regulatory framework within which the support is delivered and the transparency required by that framework. As with the Framework Support, matching of support and verification would be overseen by a coordinating agency under the UNFCCC. Coordination should be light in its touch to ensure that goals of accessibility to support are achieved, perhaps through the establishment of regional implementing agencies. The terms of the agreement between parties would be verified and registered with the coordinating agency. It is anticipated that these forms of agreement would become standardised, particularly in regard to monitoring and evaluation.

The terms of the agreement need to ensure the continued involvement of both the developer and the supporting organisation post-implementation and throughout the monitoring period to avoid the legacy of poorly performing technologies.

Once a standard agreement is developed and methodology is approved, these arrangements could be used to address housing issues in a number of emerging economies. However, there is also likely to be a limited number of project supporters. Similar proposals have been made in the form of Climate Accession Deals although focused on large infrastructure projects rather than small dispersed projects such as housing (Victor 2009).

Support to Homeowners

The analysis revealed the power of the community, when engaged with the issues, to drive through these types of projects where there is a clear benefit to them. This mechanism seeks to harness that drive and put the responsibility on communities to take control of their housing needs by utilising existing market bodies.

This mechanism is perhaps better aligned to the Peoples Housing Process and the retrofit market. The homeowner is incentivised through education and product marketing, e.g. through demonstration projects, to demand top-up funding for a ‘Home Improvement Package’. Funding would be provided on the condition that the homeowner takes out a home insurance policy for a minimum period. The insurance premium would be reduced as a result of reduced risk from fire (or improved health). This provides an added incentive to the homeowner, reinforces the value associated with the improvement and contracts the homeowner to contribute financially to the improvements. Furthermore, the involvement of the insurance industry provides additional quality assurance to the installation of the interventions.
The homeowner would be responsible for the installation of improvements and would need to be supported through skills training, coordinated through community based NGOs. Visits to sites where the Peoples Housing Process is being used to deliver new homes and the Kuyasa project, demonstrated the capacity of local communities to work together to deliver such improvements. The homeowner would also be responsible for maintaining improvements as a condition of insurance.

The role of the international community in this mechanism is in the support of domestic micro-financing and micro-insurance industries to deliver these improvements.

The attraction of this mechanism is that it is driven by the persons that benefit the most from it. The homeowner therefore needs to be incentivised and educated through demonstration projects, similar to those carried out successfully in Witsand and Kuyasa. Furthermore, there is an opportunity for local markets and supply chains to be borne out of the delivery of such home improvements. There are however a number of risks that would need to be addressed. Firstly, a means of ensuring homeowners use funding or materials to improve his/her own home and that solar water heaters are not sold off following certification, is required. Secondly, interviews suggested that the collection of payment from low income families was problematic. Finally, despite the emergence of micro-finance and insurance, there is still a danger that the insurance market will not engage with the low income sector because of the risks of non payment.

However, there are several not-for-profit micro-finance and insurance organisations that operate in the low income sector (defined by eligibility for a subsidised house) in South Africa. A review of two such funds showed a good record on loan repayments, contrary to the views expressed in interviews. The organisations are not however sustainable entities and do require donor support to cover organisational costs (Kuyasa Fund 2008, SEF 2008). Surveys on the purpose of home loans shows that only 17% are spent on thermal efficiency improvements to the home whilst most are spent on increasing the size of subsidised housing, consistent with the findings of the analysis (Kuyasa Fund 2004).

A similar scheme was proposed in the wake of the Tsunami reconstruction in Sri Lanka as a way of offering improvements to the basic shelter provision to homeowners (Wilcock 2007). Whilst risks remain in the implementation of this mechanism, it is hoped that this option will contribute to innovative approaches to the development of international policy solutions.

**Financing Direct Support**

The incremental costs of direct funding of a programme of implementation of thermal improvements are shown in Table 3. These are similarly based on the roll out of 1 million retrofit projects and 1 million new build subsidy homes, either through a series of developer or homeowner drive projects or thorough implementation of national policies for energy efficient in low income homes. Not included are the costs associated with providing additional support to meet institutional or developer needs to remove systematic barriers since these will be specific to each project and therefore impossible to define here.

Analysis shows that despite significant fuel savings, payback periods are too long to attract homeowner investment in improvements. As such, additional sources of funding would be required through grants or loans. Table 3 also shows the funding required when a proportion of the costs are met by homeowners. Homeowner contributions have been estimated based on a proportion of the fuel savings achieved by the improvements. So that immediate benefits would be visible to the homeowner, payments are based on 75% of fuel savings as set out in Table 4. It is assumed that a 5 year loan repayment period would be reasonable to the homeowner.
INTERNATIONAL SUPPORT FOR DOMESTIC ACTION

Direct Funding

<table>
<thead>
<tr>
<th>Direct capital support</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeowner contribution based on loan at 30%</td>
<td>€ 0.60bn</td>
</tr>
<tr>
<td>International Support Required</td>
<td>€ 2.21bn</td>
</tr>
<tr>
<td>Proportion of cost from homeowner</td>
<td>21%</td>
</tr>
</tbody>
</table>

**Table 3.** Direct support for incremental costs with and without homeowner contribution

<table>
<thead>
<tr>
<th></th>
<th>New Build</th>
<th>Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual fuel Savings</td>
<td>€ 191</td>
<td>€ 109</td>
</tr>
<tr>
<td>Annual contribution</td>
<td>€ 143</td>
<td>€ 82</td>
</tr>
<tr>
<td>Net savings</td>
<td>€ 48</td>
<td>€ 27</td>
</tr>
</tbody>
</table>

**Table 4.** Homeowner contribution based on 75% of fuel savings

If homeowner loans are provided through the existing microfinance markets using interest rates of 30%, typical for the low income market, the proportion of the capital cost that can be afforded is approximately 21%. If however, access to cheaper loans can be facilitated through international support, reducing interest rates closer to 15%, a greater proportion of the incremental costs could be financed by the homeowner thereby also reducing the component to be met through international support. The proportion of costs met by the homeowner through this support could be increased to 29%.

Under the contribution model, fully funded demonstration projects would need to be developed as ‘seeds’ within communities to create interest amongst homeowners and therefore drive demand for improvements. Fully funded pilots could then be phased out once momentum investment is achieved.

**Evaluation of Direct Support**

The mechanisms presented demonstrate how direct support can be configured to meet the needs of those implementing energy efficient housing at a national, provincial or municipal level, and at a project level.

Direct support differs from CDM in the upfront access to funds and in the broader focus of removing barriers, particularly at the level of government support. Whilst, nonfinancial support is focussed on delivery of energy efficient housing, the momentum of capacity building in this one area could be a catalyst for broader change towards sustainable development. Alternatively, support could be linked to issues of energy use in spatial planning and other mitigation strategies under NAMAs.

At a project level, support to both homeowners and developers would require the establishment of local or regional implementation agencies, possibly using existing market entities such as microfinance consortiums or NGO organisations.

The financial assessment shows that the homeowner could make a contribution to the investment, thereby participating in the improvement of their own home and also attributing value to those improvements. However the level of contribution afforded is highly dependent on the risk profile of low income families and the interest rate offered. The level of payment and the feasibility of low interest loans need to be balanced against ability to pay and costs of implementation of loans and insurances. The assessment here illustrates that international support mechanisms can offer loan cost components that could reduce incremental costs, in this case by a small proportion. Further analysis is required to explore what is the best mechanism to support micro-credit or micro-insurance companies so as to enhance their ability to provide the necessary loans to individuals. This might in
turn determine the relative role of loans versus grants for this component of the support. This evaluation also needs to assess whether, given the levels of poverty, homeowners should benefit from all of the fuel savings versus the argument that contributions create local ownership of development programmes essential for successful implementation. Implementation of projects with contributions is also dependent on the demand for improvements from homeowners and hence the visible benefits of such interventions need to be communicated.

There is a question of how the international community should fund incremental cost components and whether or not support should be through direct grants, transfers or by access to low interest finance. The analysis provided above tends to support the use of grants since indirect external benefits are difficult to quantify in financial terms and capital costs of interventions exceed the direct benefits in fuel savings. Since low income affordable housing in most developed nations, and indeed in South Africa, is partly subsidised to by the state, neither grants nor loans could be seen as perpetuating a sustainable business model. A critical issue therefore will be the duration of the support provided and whether support can be reduced, allowing more sustainable models for delivery to develop in its place. As barriers are removed through capacity building, skills training and learning by doing, the levels of funding could be reduced and perhaps supplemented by homeowner contribution in the longer term.

6. Suitable Indicators to Manage Implementation

The analysis of the interviews identified a large gap in the monitoring of policy implementation. The impact of this is that there is no data to scrutinise the success of policies and therefore no links to ownership or responsibility for their implementation. Table 5 sets out the policy recommendations described above along with recommendations for indicators throughout the process of policy implementation.

6.1 Input versus Outcome

The indicators proposed comprise a mix of input and outcome focused measures of success. Inputs to the system are largely quantitative, the action is either undertaken or not. The danger here is that the action may be taken to implement a code for example, but there is no indicator to assess the quality of that code. Hence the need for intermediate process indicators such as the number of homes achieving the code and a measure of those that exceed it. This provides a mechanism for feedback and learning, useful to gradually strengthen the code as the housing market responds.

While inputs to the system are directly related to the particular policy component, there is greater interaction between output indicators and the suite of policy interventions proposed. For example, the number of homes achieving the performance standard is directly related to the implementation of the code, but also indirectly related to policies for capacity building and technology development. Furthermore, the ultimate goals of reduction in growth of emissions and poverty alleviation will be influenced by other policy designs such as power sector energy efficiency and other social development policies. Therefore interaction between outcome indicators with indicators for other national policies for sustainable development is complex and as such it could be difficult to identify which measures are delivering improvements.

6.2 Qualitative versus Quantitative

The indicators proposed comprise largely quantitative data. The indicators are therefore real, measurable and less open to interpretation.

6.3 Collection cost versus usefulness

Clearly there is a trade off between the cost of data collection required for a more comprehensive data set and the effectiveness of each indicator in the evaluation of successful policies. The input indicators here are relatively simple to collate since they comprise primarily of policy design documentation. Intermediate indicators such as information on planning permissions and training statistics can be
collected from existing data sets. Output indicators require a greater level of data collection effort, for example, tracking the duration of the project process and the performance of new homes.
<table>
<thead>
<tr>
<th>Policy action</th>
<th>Indicators</th>
<th>Intermediate indicators</th>
<th>Outputs</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| Performance standard                             | - Commission monitoring of exemplar housing to establish baseline and target performance for regions<sup>1</sup>  
- Develop specification for compliance monitoring  
- Publish mandatory performance standard and best practice<sup>2</sup>  
- Construction details for achieving performance requirements to be published  
  <sup>1</sup>  
  <sup>2</sup>                                                                 | - No. planning proposals approved meeting new standard as a proportion of total applications, by region.  
- No. of homes constructed achieving certification as a proportion of subsidy homes, by region.  
  <sup>1</sup>                                                                 | - Disaggregated energy use for low income homes – per capita/per household  
- No. of homes achieving performance greater than standard (% extra over, graded), by region.  
  <sup>1</sup>                                                                 | - Energy burden low income homes  
- Residential sector emissions  
- Income of the lower quintile                                                                 |
| Capacity building                                 | - Tender for the design and implementation of vocational training  
- Award of contract(s) to implement  
- Approval of designed training programmes and targets for implementation                                                                 | - No. building inspectors trained  
- No. regional planners trained  
- No. contractors trained  
- No. and grade of government staff training  
- No. of low income community participation in vocational training                                                                 | - Duration of project programmes planning submission to certification for EE homes                                                                                                                                  |                                                                                                                                                       |
| Appropriate technology development and local industry | - Establish coordinating leadership eg NEEA, Municipality  
- Develop performance specification for SWH in consultation with homeowners and SABS  
- Innovation competition  
- Establish system of grants for prototypes  
- Streamline SABS approvals process to facilitate quicker access to market.                                                                 | - Market share of local SWH  
- Proportion of planning applications not BAU.                                                                 | - No. of houses built using alternative technologies                                                                                                                                                        |                                                                                                                                                       |
| Financial Support                                 | - Establish facility for coordinating funding national or at a municipality level  
- Implement scheme for distributing top up subsidies to achieve standard                                                                 | - Number of applications for grants through funding mechanism                                                                 | - Performance of homes receiving grants                                                                                                                                                               |                                                                                                                                                       |

Notes:
1. Currently being undertaken by NHBRC. Details will also be included in an updated building code (Getzler 2009).
2. Standard under development but not clear that will include monitoring/compliance requirements. Need to consider how corruption of monitoring and certification system could be avoided.

Table 5. Policy support for implementation of energy efficient homes and indicators of policy success
Project developers could employ statistical analysis here, such that only a proportion of new homes are monitored and the cost burden is reduced.

Outcome indicators as described above are linked to broader indicators of sustainable development. The number of homes constructed, income of the lower quintile, residential energy use and associated carbon emissions are already monitored (SSA2006, SSA 2008).

6.4 Domestic, internationally harmonised categories, internationally harmonised

The interviewees conveyed the need for a set of indicators specific to low income housing in South Africa. Since, with the exception of outcome indicators, indicators are specific to the implementation of a particular policy which by design are country specific, it is appropriate that these indicators should also be defined at a national level.

The analysis also revealed a need for assistance for the development of national indicator sets, similar to the model of NGO support to the Cape Town municipality. Therefore, concerns associated with domestic policy including indicator bias and non-standardisation could be addressed through capacity building support provided by the international community.

6.5 No verification, domestic verification, international verification

The issue of verification of reporting is similarly related to capacity to conduct verification. It is proposed that rather than an international verification process be adopted for this specific issue, that ownership for verifying data collection is at a national level but systems are supported by the international community. Broader outcome indicators reported at an international level such as carbon emissions, for example where Framework Support is provided for mitigation actions under the NAMA.

7. Conclusion

At the heart of this analysis is the very real issue of energy poverty and a basic right to quality housing. South Africa faces a huge and immediate challenge to provide affordable homes, but that challenge is also an opportunity to develop a new paradigm for low income housing. Thermal improvements to the basic subsidy house are just one component to improving the welfare of the urban poor and setting a cleaner development trajectory in support of national objectives to reduce growth in fossil fuel consumption.

The immersion approach to research through interviews and case studies revealed a series of barriers to incorporating energy efficiency measures and solar water heaters into subsidised housing throughout the project process. Principal barriers included: lack of funding, institutional capacity at all levels of governance, insufficient knowledge regarding the benefits and skills to implement these improvements. Furthermore, the gap between written policy and implementation and the absence of broad indicators of success is manifested in the creation of unsustainable communities. In the context of these barriers, it is easier for all parties to continue with business as usual.

A small number of case studies incorporating some or all of these measures were also investigated. Donor funding and the commitment of champions to overcome barriers were found to be the key drivers in moving exemplar projects forward to completion, although project aspirations of scale, timely delivery and build quality are currently rarely met.

In response to this assessment, recommendations have been made to strengthen national policy with the goal of setting higher energy performance requirements for low income housing. These include policies aimed at training and education, stimulating innovation in the delivery of technical solutions to housing and development of local industries to meet those needs. The capacity and
resources of local communities to help drive through improvements to living environments was notably demonstrable in site visits to pilot projects. Enabling policies should also strive to harness the potential that exists within those communities that stand to benefit from the interventions.

However, these policy proposals do not address the key issues of funding shortfalls and the capacity to be able to implement them. Interviewees, particularly from an institutional background acknowledged the role of international support in developing solutions for South Africa. The analysis also revealed the emerging alignment of institutions to be able to reap benefits from carbon financing.

Carbon financing through the Clean Development Mechanism however, was shown to only be able to provide part of the funding solution due to the low carbon price and small, dispersed returns relative to the required capital investment. Furthermore private financing of initial investment adds significant additional costs to project delivery due to the additional costs carbon pricing risk creates for financing in the commercial market. The narrow focus on costs also fails to address broader systematic barriers identified in the analysis. At a fundamental level, the CDM does not support projects where poverty alleviation and reduced growth in emissions are the principal aims.

Direct Support has been proposed as an alternative to the CDM, providing accessible, upfront and comprehensive support to government institutions, developers and homeowners. At the level of government institutions, mechanisms that support a framework of policy solutions to achieve these objectives are contemplated. These not only seek to provide capital finance, but also targets institutional needs such as capacity building and skills training. These can be linked to broader mitigation actions related to the built environment, including issues touched on in this research regarding spatial planning and the creation of sustainable communities. There is an opportunity for Framework Support to be linked into Nationally Appropriate Mitigation Actions proposed by developing nations under long term cooperative frameworks for climate change mitigation and the mechanism described here demonstrates a promising way to engage with government organisations to deliver domestic policies.

Options for Direct Project support to developers and homeowners have also been contemplated. The latter option proposes the use of micro-financing and insurance markets with the homeowner and local community at the heart of driving and implementing solutions. The financial analysis of Direct Support illustrates the potential for homeowner support to investment by contributing a proportion of fuel savings thereby participating in the improvement of their own home, also personally attributing value to those improvements. The level of contribution by homeowners is highly dependent on the interest rates offered against their component of the investment. The assessment here illustrates that international support mechanisms can offer loan cost components that could reduce the incremental cost component, in this case by a small proportion. Further analysis is required to explore what is the best mechanism to support micro-credit or micro-insurance companies so as to enhance their ability to provide the necessary loans to individuals.

For incremental cost components supported through international financing mechanisms, the analysis tends to support the use of grants, since indirect external benefits are difficult to quantify in financial terms and capital costs of interventions exceed the direct benefits in fuel savings. A critical issue will be the duration of the support provided and whether support can be reduced, allowing for more sustainable models of delivery to develop in its place. As barriers are removed through capacity building, skills training and learning by doing, the levels of funding could be reduced and perhaps supplemented by homeowner contribution in the longer term. The level of homeowner contributions needs to be assessed based on ability to pay and access to low interest financing.

Finally, a suite of indicators are proposed to assist in the policy implementation of energy efficiency housing in South Africa. The measures suggested are largely quantitative and comprise of a mix of input, intermediate and outcome indicators. The interviewees conveyed the need for a set of indicators specific to South Africa. Since, with the exception of outcome indicators, indicators are specific to the implementation of particular policies, which by design are country specific, it is
appropriate these indicators should also be defined at the national level. A principal outcome indicator proposed will be the ‘energy burden in low income families’.

It is anticipated that the analysis of support mechanisms and the reality of housing provision presented will assist policy makers in developing informed solutions in the consideration of climate mitigation strategies post 2012.
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Appendix

Appendix 1: Map of interview responses onto the assessment tool
Climate Strategies aims to assist governments in solving the collective action problem of climate change. It connects leading applied research on international climate change issues to the policy process and to public debate, raising the quality and coherence of advice provided on policy formation.

We convene international groups of experts to provide rigorous, fact-based and independent assessment on international climate change policy. To effectively communicate insights into climate change policy, Climate Strategies works with decision-makers in government and business, particularly, but not restricted to, the countries of the European Union and EU institutions.

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