



SUSTAINABLE
ENERGY FOR
ENVIRONMENT &
DEVELOPMENT
PROGRAMME

U R B A N S E E D U P D A T E

VOLUME 2 NUMBER 6 SEPTEMBER 2010

Making homes habitable: ceilings retrofit programme in government delivered municipal housing stock

For most people reading this, having a ceiling in our homes is a given, something we don't think about or consider or contemplate. We may not even realize the function it performs apart from being an aesthetic barrier between us and our roofs. **Ceilings are in fact an integral part of the building envelope** and without them, our homes would be challenging places to live. They provide a vital insulating layer by separating the airspace below the roof, which fluctuates wildly in temperature between day and night, from the area in which we live. By having an insulated ceiling in our homes, the living space is buffered from the outdoors and kept at a far more mild and comfortable temperature. Ceilings help keep our homes warmer in winter and cooler in summer. Now, imagine living without a ceiling.

Nationally there are approximately 2 million government delivered low cost housing units in existence without

ceilings. During the day, as the sun beats down on the exposed roof, the heat is transferred directly into the living space and it heats up like an oven. In winter any heat that is generated in the home rapidly escapes from the roof and the space is impossible to keep warm. Any moisture in the air instantly condenses on the cold roof and drips into the home making it cold and damp. Living without a ceiling condemns households to soaring energy costs and persistent illness. Ceilings dramatically improve the thermal conditions of houses, improving health and welfare of the residents. With the current housing backlog situation in South Africa, there is enormous potential to include insulated ceiling in new housing developments. This is much cheaper than attempting retrofit measures on existing buildings. The inclusion of insulated ceilings in new government delivered housing nationwide requires explicit inclusion in the national housing building



Sustainable Energy Africa

(Association incorporated under Section 21) Directors: M. Borchers, P. Wolpe
The Green Building, 9B Bell Crescent Close, Westlake, 7945 Tel: +27 21 702 3622 Fax: +27 21 702 3625
info@sustainable.org.za www.sustainable.org.za



regulations for it to manifest as a reality, otherwise housing stock without ceilings continues to grow in South Africa.

For the millions of homes without ceilings throughout the country, a **ceiling installation delivery programme is required – such a programme would be labour intensive and offers great potential to create jobs within recipient communities.**

The technical low down

Modeling software has shown the effect of ceilings on the thermal performance of low-income households and this has been validated with physical measurements (Figure 1). The effectiveness of a ceiling can be further enhanced by adding an insulating material above the ceiling or using a ceiling material, that has added insulation built in (Figure 2). The capability of ceilings to reduce energy flow into and out of homes is well understood. Government’s Environmentally Sound Low Cost Housing Draft Guidelines (1999) and the revised National Housing Code (2009) (Part 3 – Technical and General Guidelines – Specified National Housing Programmes) identify ceilings as a cost-effective solution to reducing heat gain and loss. The benefits of ceilings in reducing condensation is recognized in the ‘top up’ component of the national housing subsidy for the installation of ceilings in the Southern Cape Coastal Condensation Area (SCCCA) only (see map on right) – the SCCCA includes areas receiving the winter/all-year rainfall and high annual rainfall (between 250 mm and 500 mm per year). What has not been recognized is that there is a **huge backlog of government delivered houses without ceilings country wide and this needs to be addressed.**

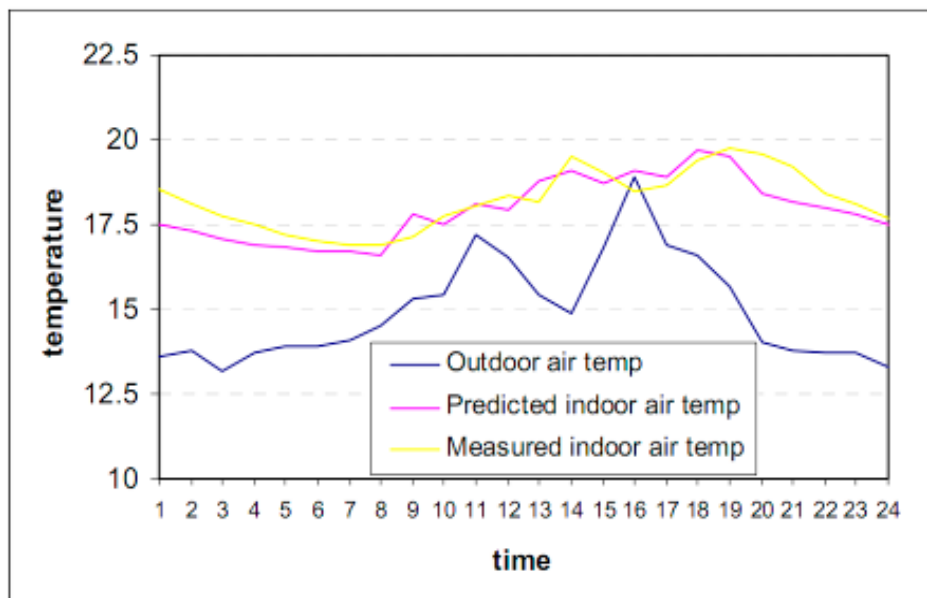
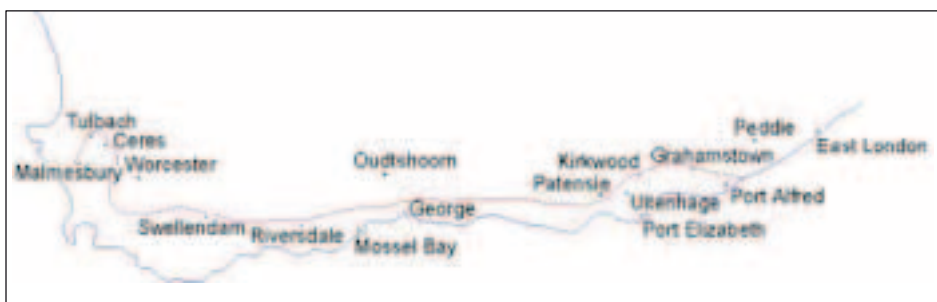


Figure 1: Predicted and measured temperatures for a house with a ceiling in Kuyasa, Cape Town (AGAMA)

	Heating Required/yr (kWh)	Improvement %
No Ceiling	2685	0%
9mm Gypsum Ceiling	1505	43%
9mm Gypsum Ceiling plus Sisalation	1216	54%
25mm Isoboard Ceiling	785	70%
9mm Gypsum Ceiling plus 50mm Isotherm	761	71%

Figure 2: Modelled benefits of different ceiling and insulation types. Model based on an RDP home in Cape Town



The Southern Coastal Condensation Problem (SCCP) Area

Financial viability

There is a compelling social, environmental and economic case for ceiling retrofits in low-income houses given the relatively low cost of the intervention coupled with the energy savings, health benefits (through increases in the ambient temperature and reduced reliance on heat sources holding fire-related dangers and negative respiratory health impacts) and job creation. Energy savings are difficult to monetise as the saved money is quickly used to fulfill other basic needs. Low-income households often cannot afford to heat or cool



their homes adequately in the first place so improved thermal performance may not necessarily reduce heating and cooling costs, but the household will be receiving an improved level of ‘energy service’ for the same amount of money. In addition, health, and related costs, is greatly improved.

Energy modeling performed for the Kuyasa Clean Development Mechanism project in Cape Town shows that the installation of ceilings in RDP homes could potentially result in an energy saving of 1345kWh per year or a 20% reduction in energy use for space heating. These modeling calculations were corroborated by physical measurements of indoor temperatures as well as surveys of energy use in homes with and without ceilings. If this energy were to be provided by electricity or paraffin, this would amount to a saving (or at least an avoided cost) of R890 per year (at an electricity cost of R0.66 per kWh) or R1570 per year (at R12 per liter of paraffin), per household, respectively.

Financing a ceilings retrofit programme

Currently there are no dedicated funds to support such a programme. However great potential lies in the following funding streams to realise mass scale ceiling retrofit delivery in South Africa:

- ✳ **Energy Efficiency Demand Side Management (EEDSM) Fund:** The new EEDSM regulations currently under development by NERSA (National Energy Regulator of South Africa) sets out to establish key areas for which national funds raised through the electricity tariff EEDSM levy may be used. Ceilings have been specifically identified as part of the Public Facilities and Housing Programme intervention to be supported by the standard offer model detailed in the draft regulations. It is anticipated that these regulations will be promulgated by the end of 2010. As with all new programmes the working of the fund still needs to be put into practice and *it is essential for municipalities to engage with the new EEDSM process to ensure ease of access for funding of ceiling retrofit programmes.*
- ✳ **Expanded Public Works Programme (EPWP) and Working for Energy (WfE) Programme:** Ceiling retrofit projects would be ideal recipients of these national funds as they create local jobs, improve livelihoods and health by providing improved housing and have proven energy savings. However a range of institutional and other challenges means that the utilization of these funds for retrofit programmes has yet to be achieved.

Housing subsidy

Currently the housing subsidy ranges between R55 000 and R84 000. The cost of installing a ceiling in a standard RDP house varies from R6500 to R7500 according to the national housing subsidy top-up available for the SCCCA and would therefore only require a relatively small increase in the subsidy to allow for the installation of ceilings in all new low-income homes.

<http://www.dhs.gov.za/Content/2FGeneric/2520Subsidy/2520Information/2FSubsidy/2520Info/2FQuantum/2520table/25202010-2011/2520without/2520contribution.pdf>



- Donor Funding:** Most ceiling retrofit programmes to date have relied on donor funding either to cover the entire financing of a few discrete and relatively small-scale pilot projects (a few hundred households), or to co-finance such pilots. Given the widespread and ever growing presence of millions of government delivered low income homes in South Africa without ceiling structures donor funding would be better utilised in creating a programme with replicable models appropriate for mass scale delivery of ceiling retrofit projects. This would need to include supporting local government in accessing national public works funds and international carbon financing to implement such projects at scale and on a sustainable basis. *It is often dedicated human capacity to pursue these new approaches and develop the institutional frameworks for ongoing delivery that needs to be supported at the local government level.*

Insulated ceiling retrofit programmes could potentially qualify for carbon revenue and this revenue stream has the potential to contribute significantly to the incremental capital costs of the interventions over the medium term, paving the way for other low income developments to pursue such revenue sources. With the advent of Programmatic CDM, tapping into such

funds is becoming more feasible – even for relatively small projects. While carbon funding for thermal efficiency in low-income housing developments (which includes insulated ceilings, house orientation and roof overhangs etc) is not yet in place, plans are afoot to develop methodologies under this CDM Programme of Activities to credit thermal efficiency. The idea is to establish a National Sustainable Housing Facility to facilitate the sourcing of carbon revenue for the implementation of carbon-reduction measures in housing nationwide, including the low income sector. Donor funding to this end could be used to assist in establishing such a facility and/or assist with the development of methodologies required to leverage carbon financing to support sustainable energy upgrades (such as insulated ceilings retrofits) in low income housing developments.

Pilot projects and case studies have proven the benefits of installing ceilings, both for households and communities. It is now time to move to large-scale, municipality wide implementation. Potential funding streams are emerging, but municipalities need to work with national government departments and programmes to make these accessible and effective.

Cape Town case study of a ceiling retrofit project

The City of Cape Town has recently implemented a ceilings retrofit programme in the community of Mamre on the West Coast. The project was funded through Danida Urban Environmental Management Programme which supports community linked climate change adaptation projects.

The Environmental Resource Management Department's unit for Sustainable Livelihoods and Greening led the project, working closely with the City's Housing Dept. The project as a whole was undertaken in close partnership with the community. This was felt to be a strong contributing factor to the success of this initiative.

Once the community had been identified, the project team from the City worked with the ward councillors of the area to determine the criteria by which to identify beneficiaries on an equitable basis. To this end preference was given to vulnerable groups within the community such as the elderly, unemployed, the disabled, child-headed households and single parent households. Community Liaison Officers (CLO's) from the Housing

Department subsequently undertook home visits within the community to identify the households that fulfilled the criteria. A total of 230 out of 400 households were identified to receive ceilings.

The consistent and inclusive engagement with the community throughout the project nurtured a sense of pride and ownership by the community and ensured that the project ran smoothly on the ground.

While the household selection process was underway, the project team embarked on the municipal tender process in search of a suitable service provider to undertake the actual ceiling installations. A comprehensive tender was developed and published detailing the specifications required for the installation of insulated ceilings. A notable feature of the tender was the request for inclusion of local labour to carry out the project.

A site clarification meeting was held in Mamre in order to familiarise the potential tender applicants with the site, the project and the importance of creating local jobs.

Subsequent to this process, the project team accompanied by the CLOs visited the selected beneficiaries to elicit their approval to having ceilings installed (which also included

their approval in them having to move their belongings out of the home on the day of installation). Approval was formalised through the signing of an official 'Happy Letter'. Once these letters were signed, implementation could commence.

During the installation period, a series of informative workshops were held with the community, in partnership with ICLEI (Local Governments for Sustainability – Africa), to raise awareness about the impacts of climate change and the benefits of ceilings in building climate resilient communities. These workshops were also used as a platform to train the community members who would assist with conducting future surveys in the community. These surveys will take place at various intervals over the next three years to determine the benefits of ceilings over a long period of time. The surveys will investigate, among other aspects, household energy use and savings, general household budget savings attributed to ceiling provision, and to determine the purpose for which these savings are being utilised by the household.

The project has created jobs for 18 previously unemployed Mamre residents. Local community members were employed to assist with the installation of the ceilings, carry out data gathering surveys and raise awareness among the community. The consistent and inclusive engagement with the community throughout the project nurtured a sense of pride and ownership by the community and ensured that the project ran smoothly on the ground.

The project cost amounted to R1.9 million, which included the supply and installation of the ceilings (including materials, painting etc) and salaries of local labour used for the project. The monitoring and evaluation costs as well as the community awareness raising costs were covered outside of this amount.

For more information, contact Cindy Jacobs (cindy.jacobs@capetown.gov.za) Unit for Sustainable Livelihoods & Greening Programmes - Environmental Resource Management Department, City of Cape Town.

Cosmo Case Study (Joburg) of a ceiling retrofit project

Cosmo City, 30km northwest of central Joburg has long been envisioned as a 'sustainable human settlement' and remains one of the only mixed-use inclusionary housing developments in the country to date. It is governed by a comprehensive environmental management plan which assigns conservation status to over 20% of the total land area. Underpinned by this strong environmentally sustainable ethos, the settlement serves as an ideal platform in which to pilot renewable and energy efficiency interventions, with a vision of having the whole of Cosmo City eventually serving as an example of a sustainable, 'climate-proofed' community.

The successful Cosmo City Climate Proofing Project initiated and implemented by the City of Johannesburg, set out to promote renewable energy and energy efficiency in low-income homes in Cosmo City. This involved the installation of insulated ceilings in homes that previously had no ceilings, was among the key interventions implemented. Other interventions included the installation of Compact Fluorescent Lights (CFLs), solar water heaters and the greening of areas previously affected by soil erosion, through the planting of trees,



shrubs and grass. The project was funded by DANIDA – the Danish development agency. While there were other interventions involved, this case-study focuses on the installation of ceilings.

To date, this was one of the largest ceiling retrofit projects undertaken in the country

involving installations in 700 RDP homes in Extension 2 of Cosmo City. The entire process spanned just over 2 years with project design and planning taking root in July 2008 through to implementation between April and September 2010.

The first challenge involved the selection of households that would benefit from the project. A limited budget meant that only a few hundred out of the approximately 3,500 households in Cosmo City could be selected as beneficiaries. Through a close consultation process with the local Ward Councillor and Community Liaison Officers, it was decided that the oldest communities would be the primary beneficiaries. This was the same criteria used in 2007, when 170 solar water heaters were installed on homes in Cosmo City. The homes next to these original 170 would receive the interventions first, after which it would be extended to other areas within

Extension 2. This proved to be an invaluable approach, as it was accepted by the community and gave a sense of continuity.

Detailed audits were performed before project implementation, to assess the state of the house structure (orientation, electrics, plumbing, roof structure, etc), as well as the energy and water consumption within the homes, in order to help guide project design and ascertain whether the interventions would be viable. The audit was used to inform the tender process and allow the bidders to submit realistic quotes based on sound, up-to-date information. A range of different interventions were assessed during the planning phase of the project, and through a process of intensive consultation with Sustainable Energy Africa and the City of Johannesburg, the most viable energy-related interventions selected for implementation included solar water heaters, insulated ceilings and CFLs. Various ceiling material options were thoroughly assessed for their energy efficient properties and cost viability aspects and Isoboard emerged as the most favourable product. Isoboard consists of an extruded polystyrene board, which acts as a combined ceiling and insulation material. It is easy to install, which was a benefit when it came to training up local labour. It also provided an attractive finish that is both water and fire resistant.

The procurement stage of the project proved a second challenge due to the timeframes involved in the tender process and the technical input required in the Terms of Reference to ensure that the contractors carried out the project as the City had envisioned. Sustainable Energy Africa's technical knowledge and experience were invaluable in resolving these difficulties through guiding the tender process and providing thorough technical input required for the Terms of Reference.

Once the contractor had been appointed, local labour had to be hired and trained. Three avenues were used to identify local labour to ensure a fair and inclusive process.



They were through: 1) the Cosmo City Project Developer, 2) the local Cosmo City organisations such as churches,

ngos's and political organisations and 3) community meetings. Once people had registered, they were interviewed for the local-labour positions. This was followed by a meeting held with the community prior the implementation phase in order to educate beneficiaries about the interventions to be installed.

After installation, various community workshops were held, including door-to-door education visits addressing issues such as maintenance and repairs relating to the interventions. A full monitoring and evaluation system was established to measure the impact of the interventions on the water and energy use within the homes and to record the perceptions of the community towards the interventions and implementation process.

The ceiling material and installation costs for each household amounted to R 5,480, which included the Isoboard, cornices, brandering, electrical conduit, light boxes and fixative. The total cost for materials and installation for the 700 homes was approximately R 383,600.00, with an additional R 300,000.00 spent on reporting, meetings, labour training, communication with households, site establishment, transport and other miscellaneous items.

The Cosmo City climate-proofing project proved to be a remarkably successful demonstration project, through its thorough, detailed and inclusive local stakeholder consultation process. This project is significant in informing future retrofit programmes. Ideally, it also serves to substantially strengthen the lobby for the inclusion of ceilings in all RDP homes nationwide; and not exclusively those in the Southern Cape Coastal Condensation Problem Area.

The Cosmo City climate-proofing project proved itself to be a remarkably successful demonstration project, through its thorough, detailed and inclusive local stakeholder consultation process.