Cato Manor Green Street
Retrofit Phase 2

Close-out Report
July 2013

Prepared for:  Green Building Council of South Africa and
Department of Climate Change & Energy Efficiency
Commonwealth of Australia
## Acknowledgement of Contributors

### Main Funders

<table>
<thead>
<tr>
<th>Organisation / Product Logo</th>
<th>Organisation Name</th>
<th>Funding / Contribution</th>
</tr>
</thead>
</table>
| [Saint Gobain Logo](#)     | Saint Gobain      | ✗ Supply of temperature / humidity probes  
                                ✗ Installation of ceilings and insulation at two houses  
                                ✗ One year learnership provided to Cato Manor residents on ceilings and drywall installation |
| [Isofoam Logo](#)          | Isofoam           | ✗ Discount on Isoboard material |
| [PropertyPoint Logo](#)    | PropertyPoint     | ✗ Training programme for Cato Manor residents focussing on plumbing and solar water installation skills and business support for the Saint Gobain programme |
| [Afripack Logo](#)         | Afripack          | ✗ Supply of Sisalation material |
| [Energy Unit logo](#)      | Energy Unit       | ✗ Supply of loggers to monitor electricity consumption and general support such as launch |
| [Architecture logo](#)     | Architecture      | ✗ Supply of temperature / humidity probes |
| [Electricity Department logo](#) | Electricity Department | ✗ Supply of electricity procurement data for beneficiary houses and assistance with the analysis process |
| [Solid Waste logo](#)      | Solid Waste       | ✗ Clean up campaign  
                                ✗ Assistance with recycling audit |
| [ASCAS Logo](#)            | ASCAS             | ✗ Supply of LED street lights |
| [Natural Balance logo](#)  | Natural Balance   | ✗ Partial sponsorship of wonderbags |
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1 EXECUTIVE SUMMARY

This report provides details on the implementation of Phase 2 of the Green Street Retrofit in Cato Manor, Durban which was undertaken on behalf of the Green Building Council of South Africa. It was made possible through funding from the Australian Government (Department of Climate Change and Energy Efficiency) and AUSAID. The project followed Phase 1 which showcased a number of green technology interventions in low cost houses during the 17th UN Conference of the Parties (COP17) policy negotiations on climate change.

The objectives of Phase 2 of the project were to extend the quality of life benefits to a further 26 families adjacent to the original Green Street, to test a number of new technologies in order to address challenges identified in Phase 1 and to extend the research over a longer period.

The technologies and activities that were implemented included:
- Solar water heating
- Insulated ceilings (40mm thick)
- Sisalation (a high quality foil insulation material)
- Ventilation
  - Airbricks
  - Turbine ventilation (whirlybird)
- Roof insulation paint
- Rainwater harvesting
- Food gardens
- Heat insulation cookers
- Waste recycling audit
- Training and work opportunities for local residents

Measuring tools consisted of the following:
- Pre and post project community survey
- Electricity consumption loggers
- 11 temperature and humidity loggers including ambient and controls

A number of interim results have been recorded as follows:
- Electricity savings of between 15% and 22% were found in a small, random sample of the houses. These figures are in line with the saving of up to 25% measured after the Phase 1 intervention.
- Additional insulation in the form of thicker ceilings, sisalation and aerolite as well as roof insulation paint have made a significant difference to temperature peaks and troughs.
- Humidity has tended to increase in the early evening due to a lack of effective ventilation
- Turbine ventilation appears to have made a significant difference to comfort levels in houses in the early evening period (more monitoring of this trend is required)
- Different types of ceiling insulation are not significantly more effective than others
- Solar water heaters were the most popular technology amongst community members.
- Through sponsorships and partnership 9 residents have received training and business support in various green technology installation fields.
- The recycling audit is being used by the Municipality to guide the rollout of a community wide recycling initiative.

The project has clearly made a valuable contribution to the green technology arena through the dissemination of new findings, lessons learned and the impact it has had on the local and national housing sectors. The project has also shown that green technologies applied in the low cost housing sector can make a real difference to energy usage and ultimately the carbon path of the country.

Finally, the community of Cato Manor as well as leadership structures have been highly appreciative of the improved quality of life of the residents through the various project initiatives.
2 INTRODUCTION

This report provides details of activities that took place on the Green Retrofit Phase 2 project in Cato Manor, Durban which was undertaken on behalf of the Green Building Council of South Africa. The project was made possible through funding from the Australian Government (Department of Climate Change and Energy Efficiency) and AUSAID. A number of smaller contributions were made by South African organisations. These contributions will be detailed in the report.

The report provides details on all aspects of the project from the start in early August 2012 until the end of May 2013. Besides the implementation details, the report provides key sections on the analysis of the impact of the project, interventions in the target community and the potential impact on the wider South African energy sector. Clearly this final report does not signal the end of the project in that its legacy will continue to be felt in the South African housing and development context. The Green Building Council of South Africa will collect data such as electricity consumption and temperature and humidity readings over the forthcoming year.

3 BACKGROUND

Since 1994, nearly 3 million government housing units were built in the low cost sector. Due to the focus on delivery, these units were implemented without a hot water heating system and without any focus on energy saving and water efficiency or insulation considerations. The country now needs to deal with the significant challenge of addressing these green efficiency backlogs. In November 2011 South Africa hosted the 17th Conference of the Parties (COP17) negotiations on climate change. The Green Building Council decided to create a legacy project to showcase the type of green interventions that could be considered for these low cost housing units. Thirty houses were retrofitted with a number of green interventions as part of the original legacy project. At the launch of this project the Australian High Commission committed to a second phase in order to extend the quality of life benefits for a further 26 families, to apply lessons learned from phase 1 and to extend certain research aspects. This would allow the project to have a greater impact on the South African housing sector and ultimately climate change interventions in the country.

4 SUMMARY OF DELIVERABLES

4.1 Community and Councillor Consultation

The fact that the project was delivered smoothly without any major delay is due in part to the consultation processes followed and the trust relationship which developed between project personnel and the councillor and his structures. Meetings took place at all critical stages of the process.

In addition, a number of community meetings were held with the 26 beneficiaries as well as door to door visits and discussions. This ensured co-operation and “ownership” of the new technologies on the part of the residents.

4.2 Municipal Stakeholder Engagement

In Progress Report 1 the Key Municipal stakeholders were mentioned as well as their inputs. The key elements were as follows:

Energy office: The Energy Office provided guidance to the project throughout the process. They also provided loggers to monitor electricity consumption in eight houses. They arranged the Municipal launch of the project.

Architecture: The Architecture Department provided a number of loggers for measurement of temperature and humidity within houses. It is also hoped that they will influence new municipal housing projects in terms of the inclusion of key “green” interventions within future design.
Electricity Department: They supplied prepaid data for the houses in order to assist with identifying changes to electricity consumption usage patterns post installation. The Electricity department also approved the installation of LED street lights in the road adjacent to the project.

Solid Waste: The Solid Waste Department assisted with a clean up campaign prior to the launch but more importantly they assisted Asiye Etafuleni with the recycling research initiative. This assistance came in the form of transport of waste, storage and sorting. It is hoped that this partnership will continue so that the original goal of establishing a small recycling station in the area can be achieved.

4.3 Surveys and Measurement Tools
A number of activities have taken place in order to assist with measurement of the impact of different interventions. The key elements were as follows:

- Pre community survey (Baseline)
- Post community survey
- Electricity consumption loggers
- Nine temperature and humidity loggers

Problems were experienced with some of the temperature / humidity loggers which would stop working at times. This has resulted in some gaps in data. Several of the loggers were replaced by a new type of logger after repeated problems were experienced with the original type.

Two new temperature and humidity loggers were purchased and installed in early May at two houses. This was due to a change in the status of the four houses being monitored in phase 2. All four houses were painted with white insulation paint and two houses received the whirlybird ventilation system. Thus, the new loggers were placed in one house with a whirlybird but no roof insulation paint and one house with no insulation paint or whirlybird systems.

A summary of the positions of the loggers, as well as the time when they were installed is provided in the table below.

<table>
<thead>
<tr>
<th>House No.</th>
<th>Temperature Humidity Loggers</th>
<th>Date Installed</th>
<th>Electricity Loggers</th>
<th>Date Installed</th>
<th>Orientation</th>
<th>Ceiling Type</th>
<th>Insulation Paint</th>
<th>Whirly Bird</th>
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<tbody>
<tr>
<td>4839A</td>
<td>x</td>
<td>19-Oct</td>
<td>x</td>
<td>12-Oct</td>
<td>W</td>
<td>Isoboard</td>
<td>x</td>
<td>30-Apr</td>
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<tr>
<td>4839B</td>
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<td>12-Oct</td>
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<tr>
<td>4848A</td>
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</tr>
<tr>
<td>4841B</td>
<td>x</td>
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<td></td>
<td></td>
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<td>10-May</td>
</tr>
<tr>
<td>4843B</td>
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<td>Isoboard</td>
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<td>x</td>
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<td>Control</td>
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<td>12-Oct</td>
<td>W</td>
<td></td>
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<td>x</td>
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<tr>
<td>Control</td>
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<td>23-Aug</td>
<td>x</td>
<td>12-Oct</td>
<td>N</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
4.4 Installation

Solar Water Heaters

Solar water heaters and pipe reticulation were installed in all houses. The reticulation included new shower systems and an additional hot water tap in the kitchen. The solar water heaters were 100 litre, low pressure, evacuated tube type systems with no electrical backup.

The solar water heater systems at two houses have still not been connected due to the fact that the houses have been built outside property boundaries and the water department does not allow installation of formal water connections.

Insulated Ceilings

Ceilings in 24 houses were installed using 40mm isoboard. Additional time and material was required due to six houses having installed internal brick partitioning to create extra rooms. Two ceilings were installed by Saint Gobain using rhinoboard and aerolite insulation material. One of the two Saint Gobain ceilings was built using the “cathedral” approach (i.e. following the roof line to give more space in the room). Temperature/humidity probes were installed at houses with Isoboard and Saint Gobain ceilings to allow for comparisons.

4.5 Sisalation

Sisalation which is a high quality foil, insulation material was donated by Afripack Coatings. The material provides an additional barrier which keeps radiant heat out of the house and is particularly useful in summer. The material was attached to the roof timber beams prior to the installation of Isoboard ceilings. At the time of installation a noticeable improvement in room temperature was apparent.

4.6 Ventilation

One of the problems identified in Phase 1 of the project was the build-up of heat and humidity under the new ceilings on hot summer evenings. It was ascertained that this was due to a number of factors including:

- Smaller room volumes
- Windows are kept closed at night for security reasons
- Some residents have extended their houses without replacing windows
- There is less opportunity for hot air to escape due to the new ceilings

Several air bricks were inserted in walls above and below ceilings to assist with ventilation. Airbricks could not be inserted in 11 out of 56 (phase 1 and 2) houses due to poor construction of the walls and in some cases a lack of space between the ceilings and the roofs. However, all the houses which we were testing for temperature and humidity had airbricks.

4.7 Electrical Installation

The safe electrification of each house included safe wiring, light switches and plugs as well as four CFL light fittings. One of the CFLs was positioned outside the entrance to improve security. All solar water heaters were earthed and an electrician certified the work.
4.8 Rainwater Harvesting

Rainwater harvesting systems were installed at all 26 houses with 11 houses receiving 2,500 litre tanks and 15 receiving 1,000 litre tanks due to space constraints. The same innovative gutter system used on Phase 1 was reused. Agricultural pipe was cut and attached to the ends of roof sheeting due to a lack of rafters or purlins on roof overhangs.

4.9 Food Gardens

Four residents who were active gardeners and had space for expansion were assisted to develop their gardens further through training and supply of tools and materials. Other residents were given training and the opportunity to develop container or vertical gardens using tyres, mesh, plastic and compost.

4.10 Wonderbags (Insulated Cookers)

Each community member received a “Wonderbag” during the community training workshop. Demonstrations were given on how the wonderbag is used to cook food and thereby save electricity.

4.11 LED Street Lights

ASKAS replaced the existing four street lights with LED street lights. The brighter LED lighting has made a significant difference to safety and security in the community.

4.12 Damaged Roof (4841B)

Replacement of a fire damaged roof and timber roof structure was undertaken at one of the houses.

4.13 Testing of Additional Comfort Level Technologies: Roof Insulation Paint and Whirlybirds

The initial temperature and humidity results presented in Progress Report 3 clearly showed that humidity levels increased in the early evening. Thus, even though additional technologies such as sisalation and ventilation had been added to houses in phase 2, there was no apparent improvement. In consultation with the representative of the Australian Department of Climate Change and Energy Efficiency it was decided to test two other technologies on several houses to see if any improvement in comfort levels could be achieved. The following was installed utilising local labour.

- Insulation roof paint on four houses
- Whirlybird ventilation system on two houses. The system is a 350mm diameter galvanised turbine ventilator with PVC ceiling grills

The roof paint was selected as initial results from Phase 1 indicated that the roof paint reduced temperatures in houses by an additional 2 – 3 degrees Celsius. It was felt that further testing of this technology would be valuable. It was felt that the whirlybird ventilation system would make a more significant impact on ventilation than the airbricks. The results of these two tests are discussed in section 7.
4.14 Summary of Deliverables

<table>
<thead>
<tr>
<th>Energy Efficiency Measures</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Solar Water Heaters</td>
<td>26</td>
</tr>
<tr>
<td>Insulated Ceilings</td>
<td>26</td>
</tr>
<tr>
<td>Sisalation</td>
<td>24</td>
</tr>
<tr>
<td>Domestic CFLs</td>
<td>4 x 26</td>
</tr>
<tr>
<td>LED Street Lights</td>
<td>4</td>
</tr>
<tr>
<td>Wonderbags</td>
<td>26</td>
</tr>
<tr>
<td>Houses with Airbricks</td>
<td>45</td>
</tr>
<tr>
<td>Houses with Whirlybirds</td>
<td>2</td>
</tr>
<tr>
<td>Houses with Insulation Paint</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: 1: The two houses that did not get sisalation were the houses in which Saint Gobain ceilings and insulation systems were installed

2: Installed at Houses in Phase 1 and 2

<table>
<thead>
<tr>
<th>Adaption Measures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainwater Harvesting</td>
<td></td>
</tr>
<tr>
<td>Food Gardens</td>
<td></td>
</tr>
<tr>
<td>Beds</td>
<td>26</td>
</tr>
<tr>
<td>Containers</td>
<td>4</td>
</tr>
<tr>
<td>Houses with Fruit Trees</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Beneficiary Statistics</th>
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</thead>
<tbody>
<tr>
<td>Home Improvements</td>
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<tr>
<td>Male</td>
<td>49</td>
</tr>
<tr>
<td>Female</td>
<td>48</td>
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<tr>
<td>Short Term work and on the Job Training</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
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<tr>
<td>Post Project Training</td>
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<td>Male</td>
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<tr>
<td>Female</td>
<td>0</td>
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</table>

<table>
<thead>
<tr>
<th>No. of Work Days on the Project</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Employees</td>
<td>180</td>
</tr>
<tr>
<td>Non Local</td>
<td>120</td>
</tr>
</tbody>
</table>

5 MILESTONES

The table below provided details on when key milestones were reached on the project.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Planned Completion Date</th>
<th>Actual Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and Municipal Stakeholder Engagement</td>
<td>15 September 2012</td>
<td>31 May 2013</td>
</tr>
<tr>
<td>Community Consultation</td>
<td>28 February 2013</td>
<td>31 May 2013</td>
</tr>
<tr>
<td>Baseline Survey and Analysis</td>
<td>24 August 2012</td>
<td>26 September 2012</td>
</tr>
<tr>
<td>Materials Procurement</td>
<td>31 August 2012</td>
<td>31 August 2012</td>
</tr>
<tr>
<td>Installation of Temperature and Humidity Data Loggers</td>
<td>24 August 2012</td>
<td>29 August 2012</td>
</tr>
<tr>
<td>Contracting of Local Labour</td>
<td>31 August 2012</td>
<td>27 August 2012</td>
</tr>
<tr>
<td>Repair of One Damaged Roof</td>
<td>31 August 2012</td>
<td>6 September 2012</td>
</tr>
<tr>
<td>Installation of Sisalation (additional insulation material)</td>
<td>31 August 2012</td>
<td>10 September 2012</td>
</tr>
<tr>
<td>Installation of Airbricks to improve ventilation</td>
<td>7 September 2012</td>
<td>12 October 2012</td>
</tr>
<tr>
<td>Installation of Isoboard ceilings, Solar Water Heaters, Safe wiring</td>
<td>28 September 2012</td>
<td>24 October 2012</td>
</tr>
<tr>
<td>Installation of Rainwater Harvesting Systems</td>
<td>28 September 2012</td>
<td>12 October 2012</td>
</tr>
<tr>
<td>Food Gardens Implementation</td>
<td>8 October 2012</td>
<td>19 November 2012</td>
</tr>
<tr>
<td>Installation of insulation roof paint and whirlybirds</td>
<td>10 May 2013</td>
<td>10 May 2013</td>
</tr>
<tr>
<td>Final analysis of temperature, humidity and electricity probes</td>
<td>7 June 2013</td>
<td>7 June 2013</td>
</tr>
<tr>
<td>Activity</td>
<td>Planned Completion Date</td>
<td>Actual Completion Date</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Progress Report 1</td>
<td>31 August 2012</td>
<td>13 September 2012</td>
</tr>
<tr>
<td>Progress Report 2</td>
<td>22 February 2013</td>
<td>22 February 2013</td>
</tr>
<tr>
<td>Progress Report 3</td>
<td>15 January 2013</td>
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<tr>
<td>Final Report</td>
<td>31 May 2013</td>
<td>12 June 2013</td>
</tr>
<tr>
<td></td>
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</tr>
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</table>

## 6 COMMUNITY SURVEYS

### 6.1 Baseline Survey

The baseline survey was completed in September 2012 and was used to develop a community profile and to understand existing activities related to use of energy and water. A selection of results which profile the community are as follows:

- 27% of the 26 residents have constructed formal extensions (brick and mortar)
- 38% of the residents have constructed informal extensions
- All of the extensions have additional energy requirements
- 27% of residents have rental occupants
- 23% of residents include the cost of electricity in the rental
- Electricity is the main source of energy at the 26 houses with coal, gas, paraffin and wood used by some houses at times

#### 3.8 What energy sources are used in your house and for what purpose?

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>100%</td>
</tr>
<tr>
<td>Coal</td>
<td>9%</td>
</tr>
<tr>
<td>Wood</td>
<td>9%</td>
</tr>
<tr>
<td>Paraffin</td>
<td>39%</td>
</tr>
<tr>
<td>Gas</td>
<td>9%</td>
</tr>
</tbody>
</table>

- Six residents were using a fan to keep cool and two were using a heater to keep warm
- 17 residents (60%) have one or more fridges
- 65% of residents were heating up water using a kettle and 42% were using a pot on the stove
- 81% of residents were pouring greywater in the yard or on the road with consequent health and environmental impacts
- Only 15% of residents had a food garden although 85% said they were interested in starting a food garden. However, only 40% of people actually had space for a garden
- 46% of residents felt that solar water heaters would have the greatest impact on their lives
6.2 Post Survey Results

The results were as follows:

Due to the fact that some residents were consistently not available to be interviewed the sample was reduced to 23.

♦ Rainwater and water consumption
  ▶ Only three residents stated that their water bill had increased since the project and 21 residents stated that they were using water from the rainwater tank. This increase could be due to the convenience of having hot water on tap (similar findings in phase 1)
  ▶ The rainwater was mainly used for watering the garden and laundry as per the training which did not recommend use for drinking and cooking
  ▶ One resident has started up a spaza shop since the project completion which would have affected water consumption

♦ Energy Consumption
  ▶ 13 residents stated that their monthly bills had stayed the same or decreased while four stated that it had increased. Reasons for the increase include a new freezer, more tenants buying electricity, increases in tariffs and a new spaza shop
  ▶ Residents are mainly using the hot water from the solar water heaters for showering and washing dishes
  ▶ There were very positive comments on the impact of the solar water heater on quality of life such as:

  "It is a good feeling not having to boil water to bath"

  "It makes life easier"

  "Life is better, I can sleep later as I don’t have to boil water in the morning"

  ▶ 13 residents experienced faults with their solar water heater immediately after installation. These were all related to leaking valves or pipes. The fact that faults were attended to by trained local plumbers provides evidence that the objective of sustainable job creation was being achieved

♦ Greywater
  ▶ The number of residents throwing greywater in the yard or on the road has reduced to 7 (30% which is down from 81%).

♦ Food Gardens
  ▶ 11 people stated that they were saving money on food since the installation of gardens

♦ Wonderbags
  ▶ The majority of residents were using their Wonderbag regularly. The few that were not using them regularly were either single men or households which did not do a great deal of cooking.

♦ Comfort Levels (Insulated ceilings, airbricks, sisalation)
  ▶ 44% of residents felt that comfort levels in the houses were better since installation while 44% felt that comfort levels were the same. These results can be explained by residents experiencing substantially reduced peak temperatures during the day but increases in humidity in the evenings during the hot summer months
An individual check of the responses from residents of Saint Gobain houses regarding comfort levels and temperatures post installation was done. The responses were as follows:

- 4939B (level ceiling) more comfortable but temperature as before
- 4845A (cathedral style) temperature hotter

We believe this illustrates that all houses with insulated ceilings require ventilation to improve comfort levels (particularly in the early evening period).

6.3 Post Survey Interviews for Houses with Insulated Roof Paint and Whirlybirds

Additional post survey interviews were conducted to ascertain if residents noticed any difference in temperature or comfort levels in their homes after the installation of roof insulation paint and whirlybirds. The results of these interviews are as follows:

- Only two of the four residents with roof paint could be interviewed.
- One stated that there was improvement in comfort levels.
- The picture was very different with the two residents with whirlybirds, both residents stated that their houses were cooler and comfort levels had improved.
- They also both stated that the improvement was at night.

Although both residents with whirlybirds clearly stated that their houses were cooler and more comfortable the actual logger results from one of the houses did not always match the view held above.

7 ANALYSIS OF MONTHLY PREPAID DATA (Oct 2012 – June 2013)

The findings below are all based on the prepaid electricity procurement data supplied for a random selection of 6 of the 26 homes by the Municipality’s Electricity Department. It was decided not to use the data from the electricity loggers which were installed in a few homes, as this data was unfortunately deemed to be unreliable (probably due to software errors).
This graph shows the monthly kWh purchased by this random selection of residential consumers (6 homes) for the period August 2011 to June 2013. The following can be noted:

- there are several gaps in the data supplied by the Municipality resulting in only three houses with complete sets of data
- 4839A shows a dramatic increase in purchase kWh from December 2012. This can be explained by the establishment of a new spaza shop from the premises of this home in early 2013. No purchase data was available for the pre-installation period. However, the logger data corroborates this pattern of expenditure.

Additional data has been requested from the Municipality in order to increase the sample size of the 26 homes. Should this be forthcoming, any new results which show a different overall result will be incorporated and communicated with key stakeholders.

**Actual Monthly Consumption Data Pre and Post Installation for the 3 houses with complete data**

This graph above shows the average monthly amount of electricity in kWh purchased pre installation (August 2011 to August 2012) and post installation (September 2012 to June 2013) by the 3 houses for which complete data was available in this period.
The following can be noted:

- All three houses (for which there is a full set of data) showed a significant decrease in average monthly electricity consumption in the post installation period as follows:
  - 4839B: 15% decrease
  - 4845A: 17% decrease
  - 4848A: 22% decrease

Thus, the finding from this random sample size is a decrease in electricity usage ranging from 15% - 22%. (Please note that if a larger sample size from this group of 26 houses is possible, and it produces a significantly different result, then this will be communicated to stakeholders.

- It should be noted that none of these three houses built extensions or started operating new businesses from the home premises during this period

8 ANALYSIS OF RESULTS FOR THE TEMPERATURE AND HUMIDITY LOGGERS

As mentioned in Progress Report 3, nine loggers were installed in houses in Phase 1, Phase 2, ambient and two controls in October 2012. A further two loggers were installed in early May 2013 following the installation of whirlibirds and roof insulation paint.

Graphs of selected periods have been produced to show trends for temperature and humidity readings for North and West facing houses as well as the technologies installed in May 2013.

The graphs are as follows:

Temperature Readings at two hourly intervals - West Facing

The following can be noted from the graph.

- The period selected in March is in late summer when ambient temperature reached 30 degrees Celsius on occasions
- The control (with no ceilings, insulation and ventilation) consistently had the highest peaks and the second lowest troughs
- The ambient had the lowest troughs
- The graphs clearly illustrate that the technologies are reducing the peaks and troughs by up to five degrees Celsius (i.e. making houses more comfortable from a temperature perspective)
- Temperatures in the houses are decreasing during the early evening period
- There is no clear difference in results between the Isoboard with sisalation and the Saint Gobain solutions
Temperature Readings at two hourly intervals - North Facing

The following can be noted from the graph above:

- The same peak and trough trends as mentioned in the West facing houses are apparent
- Again there is no marked difference between the Isoboard with sisalation ceilings and the Saint Gobain solution (rhinoboard and aerolite)
- Evening temperatures decreased inside the houses

Humidity Readings at two hourly intervals - West Facing

The following can be noted from the graph above:

- We believe that there may be a 10 to 20 RH percentage points error on the ambient logger
- The control is showing the lowest humidity reading which could be partly due to there being no ceiling and its position that is higher up the hill (there were no suitable control houses immediately adjacent to the project site)
- All the houses with ceilings experienced an increase of up to five RH percentage points during the evening period, illustrating that there is an increase in discomfort levels
The control generally had the lowest humidity readings

All the houses showed increases of up to five RH percentage points during the early evening period

These results are the same as those from the West facing houses.

**Humidity Readings at two hourly intervals - North Facing**

![Humidity Readings Graph]

- The ambient temperatures are much lower due to the fact that the period being measured is early winter
- The two houses without paint generally had peaks of one to two degrees higher (particularly 4877B) than those with roof insulation paint

**Insulation Paint - Two Hourly Temperature Readings**

![Temperature Readings Graph]
Insulation Paint – Two Hourly Humidity Readings

The following can be noted from the graph:

- As stated before, we believe there is an error on the ambient humidity reading by 10 to 20 RH percentage points
- The humidity levels of one of the houses without paint 4877B had higher peaks than the houses with paint while the other house with no paint 4843B had lower readings. Thus, no conclusions can be made on this issue.

Whirlybird Effect – Two Hourly Temperature Readings

The following can be noted from the graphs:

- The ambient temperatures show that winter weather conditions are in place with cooler evening temperatures which perhaps negates the full potential of the whirlybird to cool the house at night
- All the houses are showing a decease in temperature in the early evenings

It would be beneficial to observe the effect of the whirlybirds on temperature during a hot humid period in summer.
The following can be noted from the graph.

- Although house 4874A with a whirlybird showed higher humidity levels during the day, it generally showed a dramatic decrease in the early evening.
- House 4841B with a whirlybird showed the lowest levels at most times.
- House 4841B showed some increase in levels in the early evening.
- Although house 4843B (without a whirlybird) had lower humidity levels it still showed sharp increases during the early evening period.

Results from a period in the hot summer months will be beneficial.

In summary the key findings from the temperature and humidity loggers are as follows:

- The technology installed in October 2012 clearly reduced the peaks and troughs of temperature by up to five degrees Celsius (i.e. cooler on hot days and warmer on cold days).
- The technologies installed in October resulted in an increase in humidity levels by up to five RH percentage points in the early evenings. The additional ventilation through the use of airbricks and the use of sisalation did not improve this situation first identified in Phase 1.
- The houses in which insulation paint was added generally had decreases in peak temperatures (one degree to two degrees Celsius) during the day.
- The insulation paint did not appear to make an impact on the humidity levels in the houses.
- No conclusions can be made on the effect of the whirlybirds on the temperature in the houses. More research during the hot summer months would be beneficial.

- One of the houses with a whirlybird 4874A generally showed relatively rapid decreases in humidity in the early evening period while the houses without whirlybirds generally showed increases during the period. This is what one would expect through the provision of greater ventilation by the whirlybird. However, the result from the other house with a whirlybird 4841B did not follow this trend.
9 TRAINING PROGRAMME

9.1 Background

Five local people were employed on Phase 1 of the project allowing for beneficiaries to obtain experience in the fields of plumbing, ceiling/partitioning and electrical work. The property company, Growthpoint recognised the value of formalising the skills through the provision of accredited training programmes, small business mentoring and provision of market linkages. Growthpoint’s organisation which supports entrepreneurs, called PropertyPoint therefore offered to support skills training of the local labour who worked on Phase 2 of the project and other beneficiaries from the Cato Manor area. The key objectives of the training initiative were the following:

- Identify skills levels and needs of the local beneficiaries
- Identify appropriate training programmes
- Implement training
- Identify work opportunities for beneficiaries as entrepreneurs or as employees of other organisations

The two technical areas in which skills are being provided, are plumbing, and ceiling and partition installation. Electrical installation was not included as none of the beneficiaries had the required education levels for acceptance into this course.

9.2 Plumbing

The plumbing courses which focussed on domestic plumbing, solar water heater installation and basic business management and took place over 30 days in March and May 2013. The training was undertaken by a SETA accredited plumbing training company.
The table below provides a list of the beneficiaries who attended all 30 days of the courses. Three of the five beneficiaries worked on the Cato Manor project while two were new to the programme.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date of Birth</th>
<th>Address</th>
<th>Contact Number</th>
<th>Worked on Cato Manor Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khiphizwe Shozi</td>
<td>18 Nov 1980</td>
<td>195A Old Dunbar Road, Cato Manor</td>
<td>071 588 7078</td>
<td>X</td>
</tr>
<tr>
<td>Sibusiso Hope</td>
<td>08 April 1989</td>
<td>1289 Old Dunbar Road, Cato Manor</td>
<td>073 580 4859</td>
<td>X</td>
</tr>
<tr>
<td>Mandla Gwala</td>
<td>26 April 1981</td>
<td>D156 Booth, Cato Manor</td>
<td>072 144 0404</td>
<td>X</td>
</tr>
<tr>
<td>Dalokwakhe Ngidi</td>
<td>30 Nov 1988</td>
<td>2925 Landuff Road, Mayville</td>
<td>076 952 9832</td>
<td>X</td>
</tr>
<tr>
<td>Dumisani Msomi</td>
<td>9 Oct 1966</td>
<td>1945 Fastrach East, Cato Manor</td>
<td>074 366 1265</td>
<td>X</td>
</tr>
</tbody>
</table>

An assessment of the five beneficiaries will be undertaken shortly to review their progress to date, goals and potential. This will guide the next step in the training programme which is small business mentoring in partnership with the Small Entrepreneur Development Agency (SEDA).

### 9.3 Ceiling and Drywall Installation Training

#### 9.3.1 Training Options

Saint Gobain were involved in the Phase 2 of the greening upgrade through the installation of insulated ceilings at two of the 26 houses. They also made their academy available for training of local residents that had been involved in the project.

The Saint Gobain training programme had two options. These options were:

- A 2-3 day short course focussing on drywall and ceiling installation and skimming with no entrance requirements
- A 1-year learnership focussing on drywall and ceiling installations, communication, quantities, costing and work based skills.

The learnership also included basic business management skills.

#### 9.3.2 Selection Process

Three residents who worked on the ceilings were sent to Saint Gobain to attend the assessment session for the learnership. None of the three candidates passed the assessment. The key factor influencing this outcome was poor communication skills and limited mathematical ability. The three residents were thus put forward for the short course.

Khanyisa Projects met with the Councillor and Local Economic Development Committee with Learnership selection criteria in order to identify new candidates from the Cato Manor area. The criteria included the following:

- Preferably under 25
- Good communication skills
- Completion of Matric

It was explained to the Committee that the candidates would not be selected if they did not meet the criteria. Following this process, four new candidates were put forward who were not part of the Green Street installations but were from the Cato Manor area and were aware of the project.
All four candidates passed the learnership assessment with the following results.

- Lindo Madonda - 80%
- Philani Zondi - 68%
- Kwazi Nzimande - 60%
- Skhumbuzo Nkosiyaphansi - 85%

9.3.3 Learnership (NQF Level 3)

The training started during the week of 18 – 22 February 2013 and will be completed in late November 2013. Saint Gobain partners with many suppliers and installers to place their training candidates. They have said that if the beneficiaries apply themselves and achieve good results there is a strong possibility that they will secure a job after completion of the Learnership.

10 RECYCLING AUDIT

The recycling audit was reported on in Progress Report 3 and thus only a short summary of the background, approach and results will be provided below.

The project was included in the Green Street Initiative for a number of reasons. Recycling is a critical waste minimising strategy for increasing the life of landfill sites and reducing the demand on new raw material for products such as glass, paper and plastic. However, very little is known about the composition and value of waste emanating from the low cost housing sector. The aim of this research was thus to accurately assess the type, amount and value of waste emanating from the Green Street houses in order to assess whether a recycling initiative in the area could sustain jobs.

The research involved the following steps:

- Establishing a partnership with eThekwini Solid Waste Department
- Collection of waste from 56 houses over four collection days
- Sorting and weighing the material
- Analysis of results

The key findings included the following:

- 35% of waste was non recyclable, 34% was organic waste and 31% was recyclable waste

The recyclable waste categories were depicted in the pie chart below

The value of the recycled waste over the four collection day period was only R250 (a three to four day period)
As was stated in Progress Report 3, the number of participating houses would need to be increased four to eight times to create one sustainable job (to generate income of R1 000 to R2 000).

The organic waste does not have value in the recycling industry but could be valuable to gardeners.

The original thinking was that a recycling station could be established at or near to the Green Street. The results from the research showed that at least 500 houses would need to participate to allow for the creation of sustainable jobs. This larger scale intervention would have required a much more extensive process that the project budget did not cater for. Two other intervention options were considered.

- A methodology for using the organic waste locally through composting or digestion
- Provision of support to existing cardboard and scrap metal recyclers in the broader Cato Manor community to allow for expansion of their operations

It was finally decided to use the remaining budget for testing other technologies which may assist with comfort levels within homes as it was felt that these interventions would provide the greatest benefits to residents.

An exciting development on this front is that the Cato Manor Area Based Management Unit is implementing a recycling initiative in the area. The research gathered in this exercise will guide this rollout process.

11 LAUNCH

The launch was held successfully on 16 January 2013 and was attended by the following roleplayers:

- The Mayor of Durban: Councillor James Nxumalo
- The representative of the Australian High Commission: Sandy Collett
- CEO of Green Building Council of South Africa: Brian Wilkinson
- The representative of the British High Commission: Raksha Maharaj
- Various Senior Managers of the eThekwini Municipality (City of Durban) including Derek Morgan – Head of Energy Office
- Various representatives of Corporate sponsors and Industry leaders in the Green Building Sector
- The local councillor, his committee and beneficiaries of the projects (residents)
- Representative of National Energy Development Institute: David Mahuna

The launch involved a number of key note speakers and presentations including a project overview by Sarah Rushmere of the Green Building Council. This was followed by a site visit and light refreshments.

The launch was an opportunity to illustrate the benefits and preliminary findings of the project to high level political representatives and officials who can influence policy and project rollouts in the green technology and climate change arenas.

12 KEY INTERIM FINDINGS

Although monitoring of temperature, humidity and electricity consumption is ongoing for a further six months, a number of key interim findings have been recorded. These are as follows:

- A decrease of 15% - 22% in electricity usage for the post installation period was the result found in a small sample analysis of electricity consumption data from the municipal Electricity Dept. (These results are from the three out of six houses for which there was a complete set of data available. More data from other houses is being requested, and if this shows significantly different results then this will be communicated in a final report and with stakeholders). These figures are in line with the decreases of up to 5% indicated after the Phase 1 intervention.
- Additional insulation in the form of thicker ceilings, sisalation and aerolite as well as roof insulation paint have reduced temperature peaks on hot days and reduced temperature troughs on cooler nights.
However, humidity levels have still increased in the evenings (ie reducing comfort levels)

- Turbine ventilation systems (whirlybirds) appear to make a significant difference to humidity levels and therefore comfort levels in houses
- Different types of ceiling insulation material were not significantly more effective than others
- Solar water heaters were the most valued technology by community members
- Through partnerships and sponsorships with various organisations there has been ongoing training and business support of 9 local residents in the green technology field as well as 13 project job opportunities
- The Municipality and other stakeholders are taking the recycling initiative forward in the area

13 SUMMARY OF LESSONS LEARNED

The table below provides a summary of lessons learned over the entire project.

<table>
<thead>
<tr>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation of housing using ceilings should be considered with caution in hot humid climates such as those found in Durban and should not be considered without effective ventilation</td>
</tr>
<tr>
<td>The lack of ventilation in many houses has been exacerbated by the extension of houses adjacent to existing windows (effectively eliminating the window from a light or ventilation point of view)</td>
</tr>
<tr>
<td>Further research in the hot summer months is required to fully test the whirlybird system and the insulation roof paint</td>
</tr>
<tr>
<td>Careful checking of temperature and humidity probes is required as malfunctions can occur for extended periods with consequent negative effect on results</td>
</tr>
<tr>
<td>A few residents have worked hard at their food gardens with impressive results while other residents showed some enthusiasm for a limited period and then neglected their garden thereafter</td>
</tr>
<tr>
<td>Although the residents who were put forward by the councillor for electrical, plumbing and ceiling work had limited prior experience they applied themselves well and learned quickly under the guidance of the technical staff</td>
</tr>
<tr>
<td>Where there has been an increase in electricity consumption, this could be linked to the establishment of new spaza shops (with appliances) or extensions for tenants or an expanding family</td>
</tr>
<tr>
<td>Upfront community engagement through existing political structures ensured smooth rollout of the programme</td>
</tr>
</tbody>
</table>

14 VALUE OF PROJECT / LEVERAGE (Sponsorship)

The table below provides the details of all the additional funding or sponsorship that the project has received.

<table>
<thead>
<tr>
<th>Materials / Activity</th>
<th>Sponsor / Supplier</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply of temperature / electricity probes</td>
<td>Architecture Department</td>
<td>R 6 650</td>
</tr>
<tr>
<td>Supply of temperature / humidity probes</td>
<td>Saint Gobain</td>
<td>R 8313</td>
</tr>
<tr>
<td>Discount on isoboard (estimated)</td>
<td>Isoboard</td>
<td>R 16 000</td>
</tr>
<tr>
<td>Installation of ceilings and insulation in 2 houses</td>
<td>Saint Gobain</td>
<td>R 18 000</td>
</tr>
<tr>
<td>Provision of skills training to four residents in partitioning and ceiling installation – 1 Year Learnership</td>
<td>Saint Gobain</td>
<td>R 44 000</td>
</tr>
<tr>
<td>LED Street Lights</td>
<td>ASCAS</td>
<td>R 32 000</td>
</tr>
<tr>
<td>8 FEG Meters for measuring electricity consumption (R850 each)</td>
<td>Electricity Department</td>
<td>R 6 800</td>
</tr>
<tr>
<td>Sisalation Material (Foil)</td>
<td>Afripack</td>
<td>R 10 000</td>
</tr>
<tr>
<td>Training of Local Labour</td>
<td>Growthpoint</td>
<td>R 137 119</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>R 278 882</td>
</tr>
</tbody>
</table>
15 NATIONAL AND LOCAL IMPACT OF THE PROJECT

The project has reached and made a significant impact on a number of key stakeholders at Local Council and National Government level.

At a local level the Municipality’s Architecture Department represented by Jonathan Edkins and Laura Hunt have expressed interest in taking the lessons of the Green Street to other housing initiatives in the City. The Architecture Department is committed to the establishment of sustainable communities and the Green Street has made a significant contribution to this vision. The Architecture Department will also seek to influence the City’s Housing Department during the planning phases of new housing projects.

The City’s Energy Unit are committed to promoting the rollout of solar water heaters through the Eskom programme while the Water Departments are rolling out rainwater harvesting at houses and institutions. The Green Street project has played a role in influencing these initiatives. The fact that the most senior politician in the City, the Mayor, attended the launch bodes well for future implementation of green technology interventions.

The site continues to provide an “easy to visit” example of applied green technologies for officials, politicians, private sector organisations and academics. A University of KwaZulu Natal (UKZN) engineering student used the project for his Dissertation on energy efficiency measures in the low cost sector while a group from Massachusetts Institute of Technology (MIT) visited the project on 31 May together with UKZN academics. They hope to partner with UKZN to extend the research in the entrepreneurial arena over the next few years.

At a National and International level, the Green Building Council of South Africa continues to feature the project on their website and at conferences, seminars and meetings with people from spheres of government. In this way, they will influence National Departments such as Human Settlements and Energy during the planning phases of future housing initiatives. The attendance at the launch of David Mahuna of the National Energy Development Institute can be seen as a step in the right direction. The GBCSA have also disseminated the results of the project to many of its member organisations that it meets with on a regular basis. Some of these members have also contributed to the project through sponsorship of materials, equipment, time and training programmes.

16 CONCLUDING REMARKS

This project has made a valuable contribution to the green technology arena through the compilation of lessons learned, new research findings and the impact it has had on the local and national housing sectors. There is also no doubt that the project will continue to have an impact on the South African sustainable housing agenda in the years to come.

Sincere thanks are extended to the Australian Government’s Department of Climate Change and Energy Efficiency (in particular Byron Fay) for not only making the project possible through the provision of funding but also for playing an active role during implementation. The valuable contributions and understanding of the challenges which were faced are highly appreciated.