Energy Services

Chapter Five Contents:

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Energy Services: Introduction

Residents of informal settlements often struggle to get all of the energy services —electricity, heating and cooking fuels—they need to live. Developed with little structure or organization, Monwabisi Park has many of the same energy problems common to informal settlements across the globe. Fuel for heating and cooking can be expensive, and electricity is often unreliable and expensive to maintain. And because scrap materials are regularly used to build shacks, and insulation is too expensive for most residents, heating efficiency is typically poor. This state of affairs directly affects the resident's safety, health and economic status by making them vulnerable to the cold, fires and expensive energy services.

Traditionally the approach to upgrading in informal settlements has been extremely harsh on the community itself. The community is often displaced on large scales in order for large areas to be redeveloped. This approach requires extensive infrastructure utilities development. This restructuring would be a very drastic change for the people of Monwabisi Park, who have grown accustomed to their current living arrangement. Redevelopment has not occurred in Monwabisi Park due to the extensiveness of the problem and the lack of materials, manpower and capital of the government.

We have established many goals for ourselves in our approach to the problem. We would like to determine alternatives that would benefit the community while keeping in mind their preferences and lifestyle. We would like these alternatives to provide less dangerous and more cost effective energy practices. Lastly, we want to suggest ways these goals could be realized in the future redevelopment of Monwabisi Park.

In order for us to accomplish these goals we had to first document the current conditions of Monwabisi Park. We found that the residents of Monwabisi Park currently use a few primary energy sources to provide the services they need. Burning paraffin fuel for cooking and home heating is common throughout the informal settlements. Paraffin as an energy source has notable disadvantages being that it is more expensive than electricity, it is extremely dangerous and it causes fires which do extensive damage in the congested settlements. Electricity is provided only to those residents who have an official address registered with the government. Although this electricity used for cooking and heating is fairly inexpensive, it is often unreliable. We found some interesting statistics of the study area one of which being 61% of residents rely on illegal and unreliable electrical connections. Another important statistic is the fact that 40% of residents use paraffin for heating, even though it is clearly dangerous. We also found that it is extremely rare for residents to conserve their electricity and thusly they seem to be spending more money than necessary on the service.

In what follows we propose a possible solution to the energy problems of Monwabisi Park. We first document the current energy practices and associated costs in the community to better understand the current challenges to upgrading. We then consider energy conservation possibilities, an energy education initiative, and, more broadly, an alternative energy plan for Monwabisi Park.

Figure 5-1: An Eskom worker repairs the power lines after the fire in Monwabisi Park.

Access to Electricity

In Monwabisi Park, access to electricity is limited by a number of factors, such as high costs, lack of reliability and limited connections to official power lines.

Purchasing Electricity

As with other low-income areas in Khayelitsha, Monwabisi Park is characterized by multiple fuel uses for energy services. The majority of residents prefer electricity for cooking, lighting, and to power other appliances in the home. Electricity is provided by the public utility Eskom, which is responsible for distributing and maintaining the system of electricity prepayment. This was created to address the issue of poor infrastructure in many of the areas which Eskom delivers electricity.

Electricity is expensive for the residents of the community, costing about R0.60/unit (kWh). In order to help provide aid to low-income areas, Eskom allots 50kWh of free electricity every month for people buying electricity with a prepayment meter. Of the residents we polled, families pay between R50 and R200 each month for electricity. This is a significant portion of most families' monthly income.

Access to Electricity

A major concern of residents besides the high cost of electricity is direct access to the grid. Electricity is brought into the settlements via above ground wires on wooden poles. Each family with a box has a wire which runs directly to the top of a pole. In C section of Monwabisi Park, the southern section, C2, is made up of residents who do not have access to an electricity pole. The majority of residents in this area still use electricity, but must share a prepayment meter with someone in section C1. To do this, the homeowner must run his own wire, which costs him about R150 for 100 meters, to another home and pay the meter owner. Families without their own prepayment meter do not have access to the 50 kWh of free monthly electricity. Anywhere from 2 to 8 families share one prepayment meter in section C2.

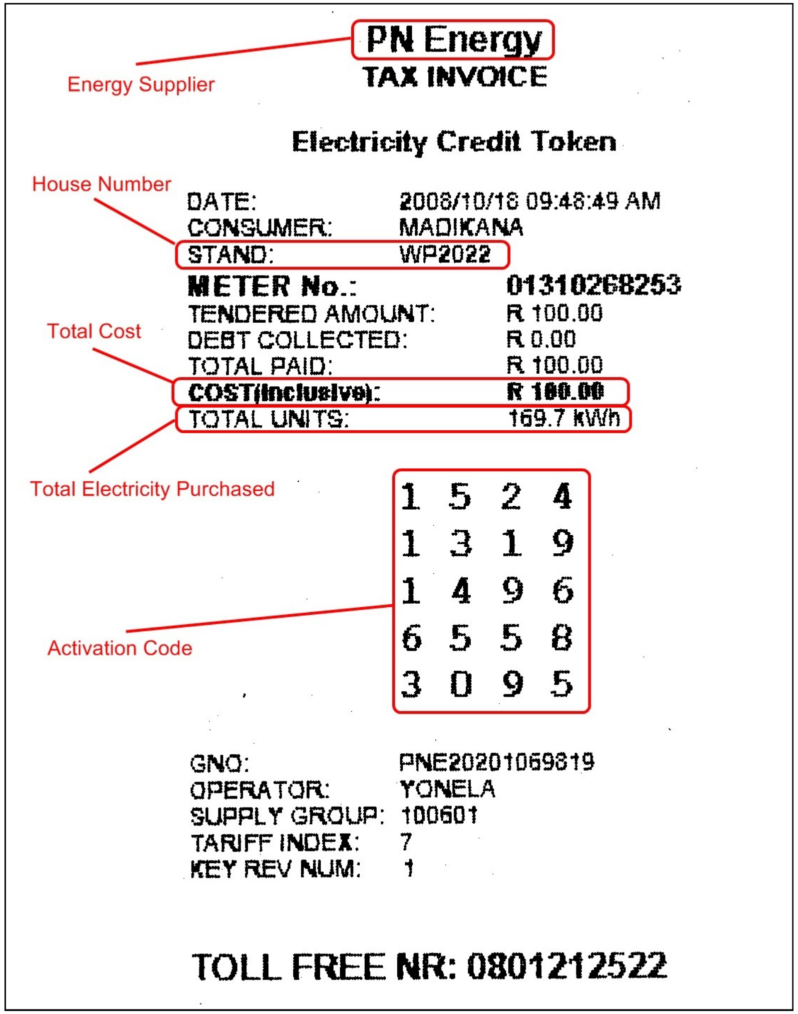


Figure 5-2: A breakdown of an electricity purchase slip from Monwabisi, showing the cost, how much was purchased, the activation code, etc.

Electricity Dispenser

The Electricity Dispenser (ED) is how residents of Monwabisi receive their electricity. The meter is installed by an Eskom employee for a fee of R200. Boxes can only be installed on homes with official house numbers. The customer can then travel to a Credit Dispensing Unit (CDU) to buy credit for a finite amount of kilowatt hours to use from their box.

There is almost unanimous agreement among residents without direct access to the electricity grid that they would like to have their own prepayment meter and not have to share a single meter with multiple families. There is a desire of residents to be inde-

Figure 4-3: Official connections fan out from power poles to boxes.

Figure 5-4: Those with informal connections must put up their own wires and poles.

Issues with Service

The homemade electrical connections used to share electricity have many problems associated with them. Long wires are often stolen by other residents. Connections which are deemed to be unsafe or illegal are taken down by city officials without warning. Many residents complain of electricity outages during rain or high wind due to exposed or weak connections. The electricity is also much less reliable when a family does not own their own prepayment meter. Most of the residents we polled said that they often experience electricity outages for long periods of time due to the fact that too many people share the same prepayment meter.

One woman interviewed said there are some months where her electricity is out for most of the month, but the owner of the prepayment meter she gets uses still expects her share of the bill at the end of the month. We were also told by two residents of times when power surges destroyed their home appliances. People without their own prepayment meter must often augment their cooking schedule to avoid using the electricity at the same time as other people using the box.

Electricity Usage

Within each household, energy use can be split into various services. These services include cooking, home heating, water heating, lighting, and powering various other appliances. Electricity is the only option for powering many of the appliances which residents of Monwabisi Park use. How electricity is used is important in order to determine how it can be better conserved and therefore cost less.

We found that many of the residents own a television, a stereo, and a refrigerator. During interviews with our co-researchers, we learned that many people leave stereos running for long periods of time, even when they are not at the home. It is clear that there are opportunities for energy conservation.

Energy Conservation

Some residents turn their refrigerator off during the night in an effort to use less electricity. Electricity is also used primarily for lighting people's homes. All homes we saw with any access to electricity had 1 or more electric light bulbs. A few of the homes we saw used compact fluorescent light bulbs (CFL) which use far less electricity than a standard incandescent bulb. The users of these bulbs were aware of the energy benefits of the CFLs. Homes without electricity mostly use paraffin lamps to light their homes.

While most of the electrical appliances don't use as much electricity as cooking or heating does, when combined they make up a significant portion of a household's monthly electricity expenditure.

Those with informal connections must put up their own wires and poles as shown in the bottom picture.

Appliance	Wattage	Hours Used / day	Monthly kWh	Monthly Cost
Electric Heater	1500	2.5	112.5	R 66.29
Electric Stove	1500	1	45	R 26.52
Electric Kettle	2000	0.5	30	R 17.68
Refrigerator	225	4	27	R 15.91
Microwave	1500	0.5	22.5	R 13.26
Stereo	110	6	19.8	R 11.67
Television	100	6	18	R 10.61
Radio	70	6	12.6	R 7.42
Fan	200	2	12	R 7.07
60 Watt Incandescent	60	5	9	R 5.30
VCR	40	2	2.4	R 1.41
15 Watt CFL	15	5	2.25	R 1.33
Cell Phone	5	3	0.45	R 0.27

Figure 5-5: Monthly home electricity usage by appliance. These numbers are based off of known appliance wattages and usage and cost estimates taken from our interviews.

Cooking in Monwabisi Park

Electricity is the preferred method of cooking by most residents because of its simplicity and low cost. When electricity is not available, residents use more expensive paraffin and LPG stoves.

Cooking Appliances

The appliances used to cook vary from home to home. Electric stoves are often the appliance of choice, however if electricity is unavailable other appliances must be used. Frequently paraffin stoves are chosen as replacements for electric stoves when there is no electricity. The paraffin for these stoves is more expensive than electricity and the stoves can be dangerous, causing them to be much less popular. There are two basic types of paraffin stoves, the flame stoves and primus stoves. The flame stoves, deemed illegal by the South African Bureau of Standards (SABS), are the most dangerous. 3 out of the 15 people we surveyed used a flame stove for either cooking or heating. Cooking with solar energy is hardly ever done. Hot boxes are insulated containers that let the food continue cooking without fuel after an initial stove heating. The only location that uses this is the community soup kitchen.

When electricity is used for cooking the costs are much less than if paraffin or LPG is used. If cooking takes 4 hours per day, it costs R3.54 on an electric stove. Paraffin costs R10 per liter and will be used in about two days. Gas is slightly less expensive than paraffin; however the initial cost of the stove is much more. The initial costs of all of the stoves are rather high, with electric stoves costing 100-150 rand, paraffin flame stoves costing 100 rand and primus costing 140-150 rand.

The people of Monwabisi Park usually cook 2-3 times per day. Depending on what they are cooking, it can take anywhere from 30 minutes to 3 hours. A common African meal, samp and beans, takes 3 hours to cook and is considered hearty and healthy. Another common meal, mealie pap, only takes around 30 minutes to cook, but is not considered to have as much nutrition.

Paraffin and LPG Usage

A common trend among informal settlements such as Monwabisi Park and many others in Khayelitsha is the use of electricity as the primary source of energy used for cooking. However, the electricity acquired by the residents of Monwabisi Park is not reliable enough to use it without any backup energy services. When there is bad weather such as rain the power tends to cutout thus leaving the residence without a source of power to cook with. As a result, most residents have a backup source of energy for the times that the electricity is not available. In section C2 this 'backup' source of electricity is their main form of energy used for cooking because they are not provided with electricity. 57% of the eighty-six people we interviewed use electricity as their primary cooking source and 23% use paraffin as their main cooking source. The cost of paraffin is too expensive for using it as the primary cooking source when compared to electricity because to cook food for three hours uses 2L of paraffin which is expensive if you are cooking multiple meals in one day. However, electricity only costs R10 for 17kW/h and that is more than enough to cook enough for a day and a homeowner usually pays between R50 to R200 a month for electricity which is much less than if paraffin was the primary energy service. LPG and other energy sources are used less frequently as a primary or backup cooking source because it costs R85 for LPG which will not last a month.

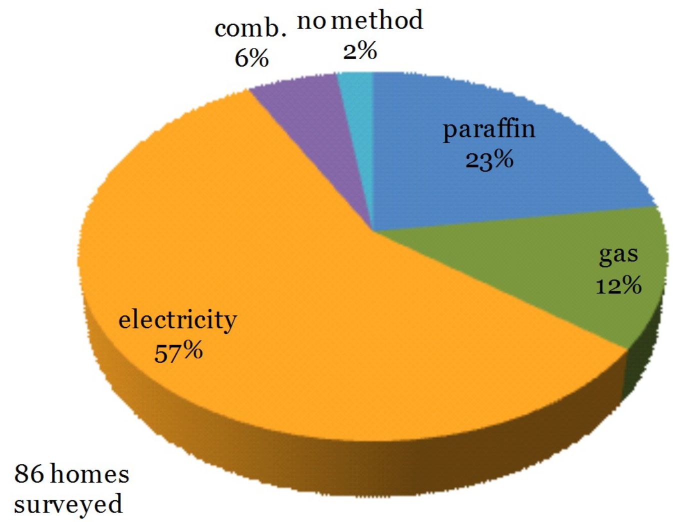
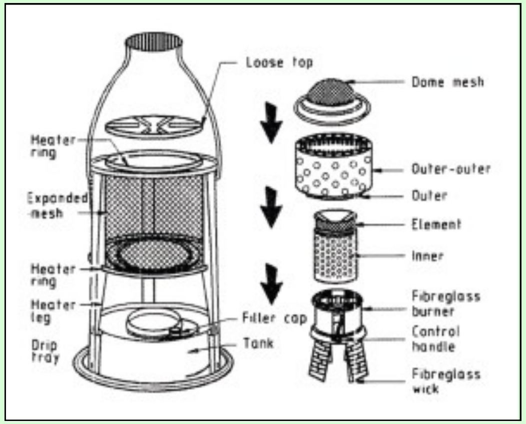


Figure 5-6: Breakdown of methods for cooking in C section of Monwabisi Park

Paraffin Stoves

Due to their affordability, the majority of paraffin stoves used in informal settlements are unpressurized units. However, the cheap nature of these stoves also makes them extremely prone to problems when in use. The point at which paraffin can catch fire is 43°C and when a standard paraffin stove is in use the entire unit heats up including the fuel. If the stove is knocked over the fuel will ignite instantaneously and potentially set fire to everything around it. However, with the paraffin maintained at a lower temperature with a unit such as the primus stove, there is a lower risk of ignition if the unit is knocked over.



Home Heating and Insulation

Residents need to heat their home and protect their houses from the cold temperatures and high winds of the Cape Town area.

Heating Homes

The winter in the Cape Town area can face low temperatures averaging 12.6° C (54.7° F) and often dropping to 7° C (44.6° F) during the evenings. The winter evenings are the coldest times faced by the people of this community. The informal construction of the homes in Monwabisi Park often uses corrugated metal, which is an extremely poor insulation material. The metal on the roofs often have nail holes or gaps between sheets which cause leaks during the incessant rain of the winter season. One woman we interviewed has to use blankets to keep her family warm during the winter. She told us how the leaks in the roof end up soaking the blankets, and then she must struggle to try to dry the blankets outside in the cold, rainy weather.

Figure 5-7: Typical shack roof which often leaks during the wet, winter season.

Paraffin is often used for home heating during the winter months. Through background research and interviews it was found that these heaters are very dangerous and often produce harmful toxins that can build up in the homes, especially if ventilation is limited. With a burning material in a home the build-up of toxic gases can form, which has killed people in the informal settlement. The danger of the device falling over is very high, and can often result in fire destroying many nearby houses. Electric heaters are not common, yet they are present in a few homes in Monwabisi Park. These electric heaters are much safer yet they do cause a rise in the electricity bill.

If paraffin is used to heat in the winter the costs are very high for the families in this community. The imbawula is popular because it is free; the fuel comes from gathered scraps and the can is recycled. While this is a very popular form of heating, it is often something the community members do not admit to unless asked directly. Electric heaters are less common, but after the initial cost of buying the heater the cost of the electricity is less.

Heating costs are often much higher because the heat escapes from the building at a very high rate. This forces the devices to constantly be running in order to replace lost heat on top of the cold coming in from outside.

Home Insulation

Some steps have been taken to "insulate" in shacks. Often times, newspapers or other scraps are placed in holes in the walls in order to eliminate the wind from entering

Figure 5-8: Current shack insulation methods include cardboard on walls, newspaper and other random materials in gaps and boards on the exterior.

Imbawula

The imbawula is a metal can with holes cut in for ventilation. They are commonly used for heating because the homeowner can collect fire-

wood from the surrounding areas and burn it in the imbawula without having to pay for fuel, which is important to someone who needs to survive on a limited budget. However, residents do not like admitting that they use an imbawula for heating because it makes the homeowner appear poorer than others because they are not purchasing fuel. After burning wood in an imbawula to a point when only hot coals remain, the homeowner brings the imbawula indoors so that it can heat his or her home without having a direct flame present. There are many safety concerns when using an imbawula, such as setting fire to the home if knocked over or the release of toxins that poison the air in the closed home.

and the heat from leaving in the winter. On a few occasions we saw people who had covered their walls with cardboard. Often this was done for an aesthetic purpose, but they realized that it would help with heat loss in the winters. Overall, insulation is very limited in the shacks and improvements are needed to improve efficiency and cut heating costs.

Paraffin and LPG Usage

The winter months in South Africa can be extremely difficult to endure when living in informal settlements because of people's lifestyles. Monwabisi Park represents how people in informal settlements throughout Khayelitsha heat their homes throughout the harsh winter season. From our interviews we discovered that an astounding 27% of the eighty-six homes surveyed did not heat their homes in the winter as a direct result of lack of funds. Electricity is the primary source of cooking used in Monwabisi Park; however, it is not the primary source of heating used by the park's residents. Paraffin and Imbawulas are the main sources of heating during the winter season consisting of 56% of the eighty-six homes interviewed. LPG is not practical in heating a home because it expensive and is not efficient enough to provide a substantial amount of heat for a home. Imbawulas usage makes up 16% of the energy usage for heating because the home-owner can collect firewood from the surrounding areas and burn it in the imbawula without having to pay for fuel; which is important to someone who needs to survive on a limited budget. However residents do not like admitting that they use an imbawula for heating because it makes the homeowner appear poorer than others which is not the case for most residents. Paraffin makes up 40% of the energy usage in Monwabisi Park as a source of heat because it is quick and effective at heating a home throughout the day. However there are many problems with heating a home with paraffin because fires and health issues arise from their usage in informal shacks.

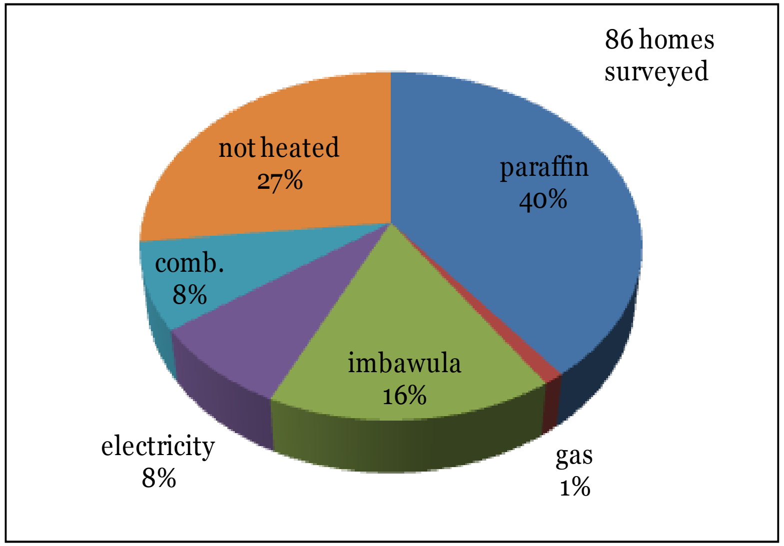


Figure 5-9: Breakdown of methods for home heating in C section of Monwabisi Park

As well as the fuel itself being toxic, the burning of paraffin also releases harmful fumes which have been shown to cause health complications in homes that use it. The combustion of paraffin is known to release carbon monoxide (CO), carbon dioxide (CO2), nitrogen dioxide (NO2), and particulate matter. Studies have shown that the inhabitants of homes using paraffin regularly can suffer from acute lower respiratory infections, most commonly pneumonia and bronchiolitis **(Muller, 2002).** The harmful effects of these fumes would be minimized if the fumes were properly ventilated, however the homes of informal settlements often have no windows and provide little ventilation. Even if these homes had windows and more ventilation, this airflow would cause much of the heat to go out as well. The residents are forced to choose between toxic fumes and cold houses. The people are limited to certain energy services because electricity and LPG are not effective sources of energy to heat a shack. Therefore, people are "forced" to use paraffin and imbawulas as a source of heat during the winter season.

Liquid Petroleum Gas Stove

Liquefied petroleum gas (known as LP Gas or LPG) is a fuel which has seen widespread use across the globe, and some successful use within South Africa. LPG is a varying blend of butane and propane. It is not renewable, but it is much cleaner, and much safer than paraffin. The stove itself consists of a steel cylinder, a simple pressure regulator, a burner, and a hose connecting the regulator to the burner. They tend to last as long as 10 years, with only the inexpensive rubber hosing needing to be replaced every few years (Bizzo and Calan et. al., 2004). Propane and butane in their regular forms are gases, and LPG only becomes a liquid when it is pressurized. Because of this, LPG comes in pressurized cylinders of varying size designed specifically to be able to withstand the pressure of the gas, and safely release the fuel into a stove without leakage. As LPG becomes depressurized, it turns back to a gas, so within the tank, the liquid stays at the bottom, while the vaporized LPG floats to the surface and is released. This leads to safety concerns, because LPG in its gas form is invisible, and can rapidly ignite if proper care is not taken.

Solar Water Heaters

Utilizing the solar radiation in the Cape Town area, Solar Water Heaters are a technology which can provide reliable hot water with no fuel cost and minimal maintenance. Because of the high up front costs, these devices would be best utilized in community buildings or in a centre where many residents could get hot water.

Solar water heaters are a popular energy saving measure in middle to upper class areas of South Africa. SWHs provide an effective hot water supply with no fuel costs, and minimal required maintenance. Available SWH designs have certain requirements that make them impractical for individual ownership in Monwabisi Park. Firstly, they require substantial initial capital to purchase and have installed. They must be safely secured and properly oriented, requiring professional installation. As seen in Figure ***, purchase and installation of a close-coupled unit can cost R15 000 or more. Residents of Monwabisi Park cannot afford such an investment.

The SWH must also be mounted on a roof, or some other raised area to properly function. They hold a 150-300 L tank, and therefore must have a secure roof to be mounted to. The construction of shacks in Monwabisi do not allow for such a structure to be attached to them. Attempting to mount a SWH to a roof of a shack would be very unsafe.

SWHs also require a constant piped water source to function properly. Currently no residents have water piped to their house, and the water provisions department of Cape Town currently has no means of expanding water piping or water taps in the area any time in the near future. Piping water to each home is unrealistic and is not considered in our plans for future redevelopment.

With an expensive piece of technology like a SWH, theft is a concern in Monwabisi Park. Copper piping is very valuable, and any system designed with copper has the potential to be a target of theft. When we interviewed city staff member Wouter Roggen about the Kuyasa Programme, he said that copper piping which is painted black is both more effective at absorbing thermal radiation, and disguises the metal making it less likely to be stolen. Along with theft, the issue of maintenance would be difficult for an individual owner to deal with. While Mr. Roggen informed us that there had been very few required repairs to the Kuyasa SWHs to date, some repairs are inevitable and would likely be very expensive.

These factors make the idea of having each home equipped with a solar water heater unrealistic. A more feasible idea would be to have a centralized facility that could provide hot water to a portion of the community. A single building with enough roof space to fit multiple heaters could generate a great deal of hot water. This water could be provided to people in insulated carrying containers. People could pay a minimal fee to have access to this water, helping somewhat offset the initial capital investment, or provide employment to someone working at the facility. The idea of centralized hot water was introduced to some members of the Street Committee during the first charette, and it was well received.

Participating Supplier	Active areas	Registered System	Indicative retail price	Expected installation	Qualifying rebate
Alt E Technologies Regional contact numbers: Gauteng: 086 111 6182 Western Cape: 021 511 9504	Eastern Cape Gauteng KwaZulu-Natal Western Cape	**Alte GH 150i** 150 Litre Flat Plate Indirect Thermosiphon	R13 000,00	R2500,00 – R3000,00	**R2211**
		Alte K 200-1i 200 Litre Flat Plate Indirect Thermosiphon	R13 140,00	R2500,00 – R3000,00	**R2084**

Figure 5-10: These, and many other SWHs are included in a list of Eskom-accredited suppliers. Eskom will provide a rebate for households who install one of these SWHs.

The Kuyasa Programme

Registered as a project of the Clean Development Mechanism of the Kyoto Protocal on 27 August 2005, the Kuyasa Programme seeks to improve the energy efficiency of homes in Kuyasa, Khayelitsha. It seeks to achieve this by outfitting 2300 homes with 3 energy improving additions:

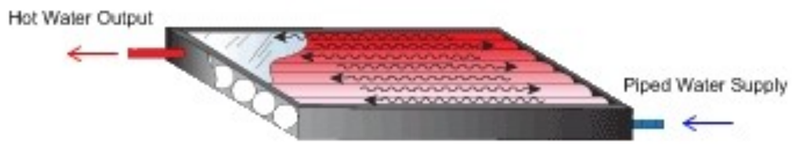
1. Solar Water Heaters
2. Insulated Ceilings
3. Compact Flourescent Lighting

After starting with a testing group of 10 homes in 2003, the program is currently working on installing these additions in 2 300 homes in Kuyasa.

The Kuyasa project was the first project in South Africa to be registered as a CDM project, and the first in the world to be awarded the UN's "Gold Standard" for CDM projects.

The carbon emission reductions caused by the implementations of the Kuyasa project are registered by the CDM and sold as partial funding for the project.

There are many different designs available for SWHs, but they fall into two main categories: close-coupled systems and integral systems. A close-coupled system consists of three parts: an absorbing plate, energy transfer loops, and a storage tank. The storage tank is mounted above the absorber, and cool water flows from the bottom of the tank through the transfer loops into the absorber. The water is then heated by the sun, and flows back into the storage tank in a process known as thermosiphoning. The integral unit consists of an absorber which is large enough to double as a storage tank. The close-coupled unit is approximately 4 times the initial cost, but is much more efficient than the integral system, achieving higher temperatures for longer periods of time. The testing phase of the Kuyasa Programme involved the installation of 8 close-coupled systems and 2 integral systems.

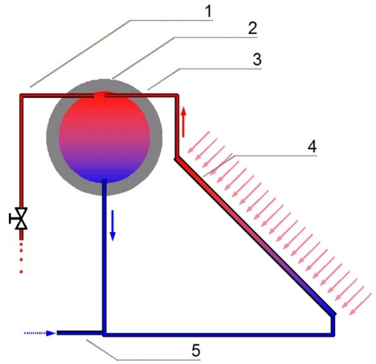


Integral SWH *diagram with input from a public water supply, and output into household faucet.*

Water from a close-coupled SWH is heated to above 50˚C, but loses temperature as more water is required. There is a limit to the rate at which hot water is produced. According to Figure 5-11, the heater can only produce about 60 litres of water above 40˚C at once before it needs time to heat up again. Tests would need to be conducted to see how much time they would need to heat up before more water can be drawn.

A centralized facility would also need a source of backup heating ability. SWHs will not function well on overcast days and a system of LPG or electric water heating would be necessary. A system of extremely efficient kettle-like water heaters that heat water with exposed heating elements in insulated containers could be used in order to minimize the electricity drawn by the water facility.

Overall, the facility would require a building to house one or more employees to maintain the water heaters, and to store insulated water transporting vessels. The building would require adequate secure roof space to hold enough SWHs to provide hot water to the portion of the community the facility serves. A piped water source would need to be run from the city's water supply in order to provide the SWHs with a water source. Plumbing within the house would also need to run hot water from the SWHs down to a faucet for filling containers. The capital required to create such a facility would be substantial, but it would provide a necessary service to the people of Monwabisi Park in a sustainable way which promotes a sense of community.



Close-coupled SWH
1: water tap
2: isolated container
3: warm water inlet
4: solar thermal collector
5: fresh water supply

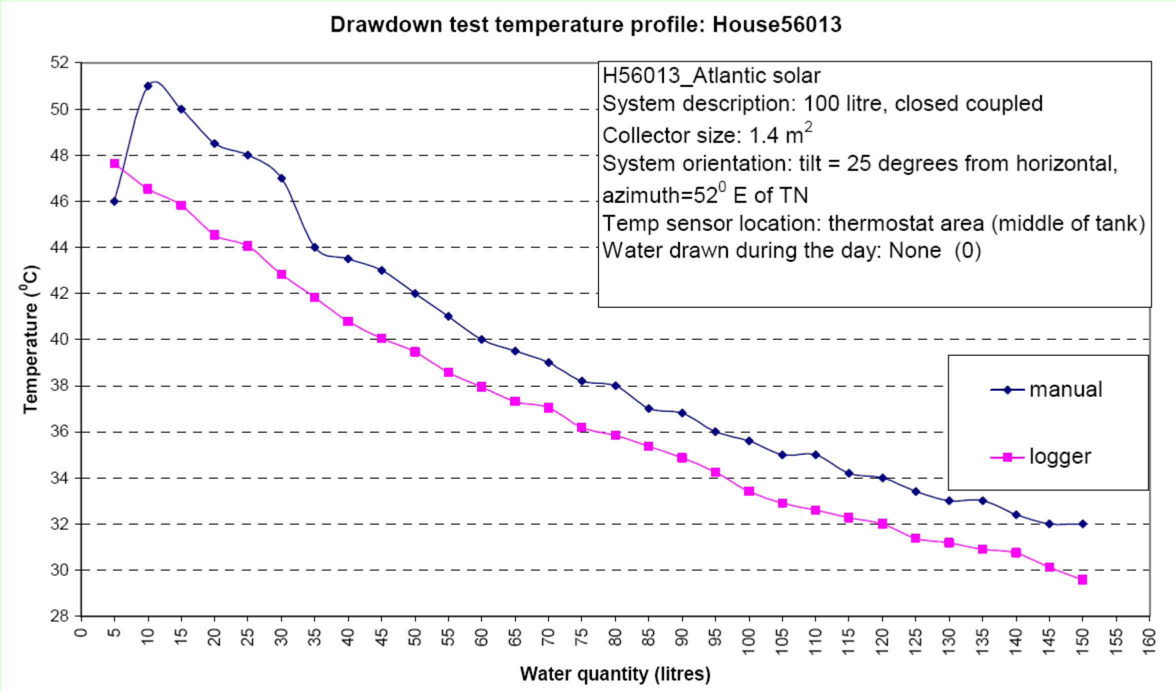


Figure 5-11: As part of the testing phase of the Kuyasa Project, a close-coupled SWH was tested for temperature output. The water was tested by a data logger inside the storage tank (pink) and manually at the faucet (blue). As more water is continuously drawn from the system, the temperature steadily declines.

Household Electricity Conservation

Steps toward a sustainable community must start with households learning how to reduce energy costs making efforts to conserve electricity.

Based on our research of existing conditions in Monwabisi Park, there are many opportunities for residents to conserve electricity. Electricity conservation can be achieved on a community-wide scale, or just by a single home monitoring its electricity use. We learned that many people in the community run appliances longer than they need to, without realizing how much electricity they are actually using. The City of Cape Town's Environmental Resource Management Department suggests in its SMART Living Handbook that every household create an "Electric Appliance Audit Sheet," which documents the same data as in Figure 5-5, but allows the resident to fill out the actual appliances and usage rates in their home. Making some simple calculations can show people exactly how much each appliance is costing them each month. It also allows people to see, for instance, how much money they could save each month if they turn off an appliance for a certain period of time each day.

Creating a complete electricity audit for a household will not be possible for many residents. Most residents of Monwabisi Park will not be able to perform the calculations necessary to accurately predict their monthly electricity usage. This task could instead be performed by an energy specialist. For people who need assistance with the calculations, they could simply fill out the type of appliance they use and the number of hours they use it each day. The wattage of the device could be either read off the device, or the Energy Specialist would be able to make an estimate based on the model of the appliance. The energy specialist would have data on typical appliance wattages, and be able to make an accurate estimate of the electricity used by each appliance. Running these figures through a simple spreadsheet could produce a complete electricity budget for the household. The Energy Specialist could also show potential energy savings by also showing the cost of appliances with slightly reduced usage times.

The exercise of performing this electricity audit is to inform people of exactly how much money they are spending with each individual appliance, as opposed to just seeing how much their total electricity is costing them. It creates a better awareness of costs, and show where there is opportunity to save. As shown in Figure E1, the majority of an average home's electricity usage goes into cooking, heating, and refrigeration. Therefore, people can focus on those services, where there is the most potential to save money.

The simplest way to save electricity is to just use appliances less. If residents used a 1500 Watt electric plate stove for just 30 minutes less each day, they would save R13 each month. Using awareness of the cost of different appliances, limiting the use of all appliances could turn into substantial energy savings. Refrigerators, however, are one appliance where limiting time that it is "turned on" is not necessarily helpful. We learned that some residents of Monwabisi Park turn their refrigerator off at night in an effort to save electricity. Turning the fridge off for a period of time every day will not actually save any electricity. The fridge only consumes electricity when the internal temperature drops below a certain level. They use very little electricity when they stay closed for long periods of time, and if it were allowed to heat up over the course of the night, it would run for a long time when it was turned on in the morning. A comparable amount of power is used, and food can spoil in a fridge that does not stay cold throughout the night. Keeping the condenser coils clean and making sure the rubber seal on the door is intact, however, are good ways to make sure your refrigerator is as efficient as possible. However, the best way to reduce electricity usage for refrigeration is to purchase a new refrigerator. Refrigerators today use as little as 200 Watts when running, which is many times less than refrigerators of the past.

GE® ENERGY STAR® 25.4 CU. FT. SIDE-BY-SIDE REFRIGERATOR

578 kWh
Estimated Yearly Electricity Use

Monthly Electricity Use:
48 kWh/month
Monthly Operation Cost:
R28/month

Power Ratings:
Volts: 120V
Hertz: 60Hz
Amps : 15A

ENERGY STAR

Electric lighting is essential to most residents of the community, and the majority of people we met use inefficient incandescent light bulbs. The use of Compact Fluorescent Light bulbs (CFLs) could greatly reduce energy usage. A 60 Watt incandescent bulb can be replaced with an 11 Watt CFL that provides the same amount of lighting. However, he upfront cost of purchasing a CFL is about 5 times greater than an incandescent bulb, costing about R12 for an 11 Watt CFL. It is difficult for low-income families to make the investment in a much more expensive bulb, even if it would save them money farther down the line.

In an effort to provide people who are not able or willing to pay the upfront costs with CFL replacement bulbs, Eskom has a "CFL Exchange" programme. They send Eskom employees house to house to install CFLs for free in exchange for the old incandescent light bulbs. The programme was started in response to rolling blackouts across South Africa due to insufficient energy supply. To date, Eskom has provided residents in South Africa with 22.2 million CFLs. According to Eskom, if every household in South Africa were able to switch to CFL lighting, it would save a total of 1,350 MW, which half the amount of electricity that can be produced by a coal-fired electricity plant.

Appliance	Old Wattage	New Wattage	Old Hours Used / Day	New Hours Used / Day	Old Monthly kWh	New Monthly kWh	Old Monthly Cost	New Monthly Cost	Savings
Electric Stove	1500	1500	3	2.5	135	112.5	R 79.55	R 66.29	R 13.26
Refrigerator (2008)	500	250	4	4	60	30	R 35.36	R 17.68	R 17.68
Electric Kettle	2000	2000	0.5	0.5	30	30	R 17.68	R 17.68	R -
Television	150	150	4	3	18	13.5	R 10.61	R 7.96	R 2.65
Stereo	50	50	6	4	9	6	R 5.30	R 3.54	R 1.77
11 Watt CFL	60	11	4	4	7.2	1.32	R 4.24	R 0.78	R 3.46
						Total:	**R 152.74**	**R 113.92**	**R 38.82**

Figure 5-12: Potential Energy Savings for a typical household in Monwabisi Park.

The Cape Town area had a roll-out of free CFLs in 2006, and we saw that one of the women we interviewed had a bulb that was labeled as part of a free Eskom roll-out. By the end of 2008, Eskom will have given out approximately 35 million CFLs, which they believe will just about saturate the market, making future roll-outs much smaller. Eskom intends to resume CFL roll-outs as this generation of free lamps starts to die out. The Department of Minerals and Energy, however, has started talks about banning incandescent bulbs, which would end the Eskom roll-outs.

To show the potential for a single household to reduce their electricity use, we have created an electricity audit that would describe an average household in Monwabisi Park. To save energy we suggest first of all running the electric stove just 30 minutes less each day. This can be achieved by either not cooking as often, or by using a hotbox to reduce cooking times. To reduce the cost of refrigeration, the 500 Watt fridge could be upgraded to a new unit which only runs at 250 Watts. The television and stereo could be turned off for a period of each day, and the incandescent bulb could be replaced with a CFL. All these energy conservation ideas would result in R39.60 being saved each month.

Without the expensive refrigerator upgrade, these energy saving measures would still save approximately R20, which is about 1.5% of a person's income who earns R1 500 a month. They are very simply measures, which would not require high initial capital, or practices that would be difficult for people to incorporate into their daily lives. With upgraded appliances, and stricter reduction of appliance usage, households could easily save much more.

CFLs come in a variety of wattages, shapes, and light qualities

Redevelopment: Insulation

Benefits	Reduces amount of energy needed to keep home warm.
How it Works	Decreases heat lost through exterior surfaces.
Used in Community?	Was used in old community center buildings.
Ways of obtaining	Local hardware store.
Money Spent	Varies
Money Saved	25-75% of current energy costs
Problems to Be Considered	Fire, Leaking ceilings, Installation, Ventilation

A major waste of energy in Monwabisi Park comes from the loss of heat in the winter due to poorly insulated shacks. Roughly R300 is spent monthly to heat the homes in the winter and it is estimated that 25-75% of that cost could be saved by insulating various parts of the homes. Insulation is another example of a solution that has a higher initial cost which makes it difficult for community members to take advantage of it. Insulations that are available in the Cape Town are depicted in the figure to the right.

Insulation is used to reduce the amount of heat transfer through a home's outer surface. The amount a material can resist heat transfer is defined as its "R-Value." The greater the r-value the more effective the insulation is. The SI unit for r-value is Kelvin square meters per watt ($K*m^2/W$) but in the United States degrees Fahrenheit, square feet hours per Btu ($ft^2 \cdot {}^\circ F \cdot h/Btu$) is used instead. Using insulation can reduce the amount of money needed to heat a home in the winter and keep it cold in the summer. Heating a home in the winter in Monwabisi Park is vital and often requires a decent amount of their monthly income. Money is a very important factor in the resident's lives and anything that they could save would be beneficial.

Insulation can be installed in the walls and ceiling of a home. The most critical areas are the outer walls and the ceiling. There are many different types of insulation available to the people in South Africa. Common insulation materials used are isotherms, isoboard, cellulose and sand. Basic information about these materials is shown in figure ##. Isotherms re an environmentally friendly material which is made from recycled plastic bottles. Isotherms are readily available in local hardware stores and sell for roughly 200 rand per roll. This is a huge initial cost for the people of Monwabisi Park whose average income is around 1500 rand/month. To decrease the amount of insulation needed to insulate a home it would be practical to insulate just the ceiling. A huge portion of heat is lost through the ceiling due to the fact that heat raises and often gathers in the top portion of the shack. Economically insulating just the ceiling would be most beneficial to people who lack significant funds to cover the initial cost of the material. Isoboards can accomplish this type of insulation easily and could eliminate the need for decorative 'ceiling boards' that a portion of the homes in Monwabisi Park have. Using sand as an insulation material is common in ecobeam construction. This construction fills the spaces between the ecobeams with bags filled with sand which act as an insulation to the home. This insulation is only possible in the walls of the building, however, and another type of insulation would be needed to insulate the ceiling.

Insulation is not a concept that is very common in Monwabisi Park. Currently no shack we toured had used any form of insulation. The closest concept we encountered was the fact that people placed balls of newspapers in the voids between their building materials to eliminate the effects of wind they could feel through these holes. In the old community center buildings, however, insulation was used in the walls. In the Guest House sand was used as insulation due to its ecobeam construction; in the youth center/soup kitchen/health clinic isotherms were used in the walls; in the backpackers lodge sand was used, again because of its ecobeam construction. Buyiswa, a respected resident and community center employee, said she could often feel the effects of the insulation in these buildings compared to other buildings that lacked the insulation. She said that these buildings often were warmer in the winter and cooler in the summer and that the heating costs of the buildings were significantly less than what they would have been if the buildings lacked insulation. Another current use of insulation materials can be seen in the Kuyasa project. This project is located in another area of Khayelitsha and is implemented in government housing. These houses are more formalized than the shacks of Monwabisi Park; however the concept

Insulation Type	R Value ($K*m^2/W$) 40mm	50mm	75mm	100mm	Ease of Access to Ceiling	Fire Proof
Isotherm	0.88	1.10	1.65	2.20	Must Uninstall and Can Reuse	ASTM-E84
Isoboard	1.33	1.66	2.50	3.33	Can Remove Similar to Ceiling Board	B1 (difficult to ignite)
Cellulose Fibre	1.05	1.31	1.97	2.63	Must Remove and Cannot Reuse	Fire Resistant

Figure 5-13: Specifications of various alternative insulation materials.

of the insulation remains the same. Isoboards are used for insulation in these homes and is installed on just the ceilings. This project is city funded and is meant to help conserve energy in the area. It is still in its beginning stages but the city feels as if it is beneficial to the people of the community.

Current conditions in Monwabisi Park allow people to buy insulation at the local hardware store. The insulation would be more efficient if it were installed properly by a professional. This could open a job opportunity for someone in the community who could be trained on the most efficient installation method. If a professional is not available, however, it would still be beneficial for people to install the insulation on their own. An initial cost is needed to purchase the material. This initial cost is almost impossible for many people in the area. In order to help with this a 'payment plan' might be created for the residents to acquire the insulation or the government might help subsidize the cost. Either option would have to be assessed more. Another payment option for these materials is the Economy Team's idea of "complimentary currency." The insulation, hot boxes, and solar water bags could be goods the workers receive after they have completed a certain number of hours of work. This would also have to be investigated further.

Isoboard

www.i-w.co.za/isoboard.php

CONTACT INFO:

Isoboard: Western Cape

Tel: +27 21 983 1140

Fax: +27 21 981 6099

Address: 23 Kenwil Dr, Okavango Park, Brackenfell

Email: southsales@isoboard.com

Isotherm: Cape Office

Tel: +27 21 480 3140

Fax: +27 21 424 7710

Address: 10th Floor, South African Reserve Bank Building, Cnr Hout and St Georges Mall,

Cape Town

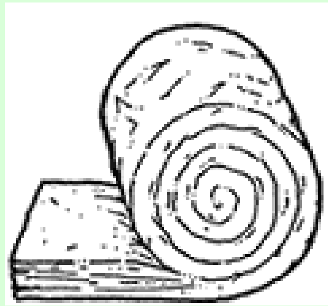
While insulation can be greatly beneficial to the community, many problems must be assessed. Fire, leaking ceilings, installation methods, and ventilation are all common problems in the homes of Monwabisi Park. The resistance to fire is a huge factor that should be evaluated when choosing an insulation material. The ability to resist fire is outlined in figure ____. According to this, isotherms, isoboards, cellulose and sand will not catch on fire. They will all melt or fail in a fire however they will not spread the flames.

Another problem to consider when insulating a ceiling is the fact that these shacks are often not constructed perfectly. Many of the shacks in Monwabisi Park have leaks in their ceilings and addressing these leaks is necessary. Covering the ceiling with insulation hinders the ability to check for leaks and also could cause the insulation to work less efficiently due to the moisture. Because of this cellulose and isotherms do not sound like a good form of insulation for the shacks' ceilings. The installation methods, addressed previously, would need to be addressed by either implementing an 'installation specialist' or by including a pamphlet on proper installation techniques. The isotherm company provides an 'Installation Guide' on their website that describes in detail how the product should be installed.

The last problem that must be considered is the need for ventilation in the buildings. The people of this area commonly burn paraffin or wood in order to heat their homes in the winter. Burning these materials releases toxic gases. These gases need to be ventilated to the outdoors in order to prevent injury to the people in side the building. The use of insulation could block many venting areas of the building and therefore these venting areas should be relocated to other areas of the building. This ventilation could be addressed in many ways including the installation of a chimney, airbrick, or vent. The installation of one of these ventilation devices would be more feasible in a new formal building rather than a shack. While it is possible to install in a shack it might be easier to simply cut a hole in the shack's upper wall. The design of the newer buildings should incorporate a ventilation device to eliminate the build up of toxic gases.

When redeveloping areas of Monwabisi Park, and other informal settlements, insulation should be highly considered. If the ecobeam structure is used the sand in the exterior walls is an acceptable insulation material. The ceilings of these buildings should be insulated as well, however, due to the large amount of heat lost through the top of the building. Isoboards, isotherms, and cellulose all would be beneficial to the community in the new buildings but some require more installation time and effort than the others. Cellulose, for example, must be blown in by a professional with professional machinery. The easiest building material to insulate the ceilings is isoboards, which require less installation time and energy. The Kuyasa project has proven that these isoboards are beneficial and do not require much time to install. A great deal of energy used for heating the new homes will be saved if an insulation material is utilized.

Isotherm www.google.com



Redevelopment: Hot Box

Benefits	Eliminates need to keep stove on for long periods of time.
How it Works	Adiabatic Cooking (insulated box keeps heat in cooking pot).
Used in Community?	Occasionally
Ways of obtaining	Cape Town stores or www.theHOTBOXco.co.za
Money Spent	195 rand-250 rand
Money Saved	2 rand/day
Problems to Be Considered	Meals must be planned in advanced

A hot box uses adiabatic cooking in order to eliminate the energy needed to fully cook a meal. Some of the meals in Monwabisi Park can take up to three hours to cook. The use of a hot box could decrease the stove time to only half an hour.

Hot boxes are currently used in the Monwabisi Park community occasionally. Hot box users notice that they use less electricity and that their food is cooked just as well as the conventional cooking method. In one of our interviews, a cook at the Indlovu Center's soup kitchen, said she used a large hot box when cooking for the community and it worked extremely well. Cooking samp and beans, vegetables, and mieliepap all worked extremely well and saved the soup kitchen a lot of money in fuel costs. The only 'inconvenience' found with the use of the hot box was the fact that meals would have to be planned in advance due to the fact that they took longer to cook. This was easy to get accustomed to, however, and the cook was very pleased with the device.

Using a hot box eliminates the need to use a stove for long periods of time. The stove is only required to get the water to a boiling point. This takes roughly 5-15 minutes, depending on the amount of water and the heat of the stove. For a meal that takes 1 hour to fully cook, 45 minutes of stove time would be saved using the hot box. This meal would take longer to cook in the hot box; however once it is placed in the hot box it requires no additional energy. If a hot box was used for two meals like this is one day, stove time would decrease by 1 hour and 30 minutes. According to our electricity usage chart, this would save the person roughly 1.30 rand daily. In one year a resident could save 485 rand which would double the initial cost of the hot box.

Overall, the current energy used for cooking in Monwabisi Park could be lessened greatly with the use of hot boxes. This would save the people of Monwabisi Park money as well as help the environment.

While hot boxes are easy to buy in the Cape Town area, sometimes it is difficult for informal settlement residents to purchase them. They are not very common and many residents who used them in the community said they got them as a gift from someone in the city. There are salespeople located around the city and a list of these people can be found on the hot box company's web site. Commonly the Hot Box Company sells a small for 195 rand and 250 rand for a large. These devices are simply made from fabric with insulating Styrofoam beads inside which help keep the heat inside. This design could be replicated using the sewing machines in the economy team's sandbag factory. Another way of purchasing is for someone to buy a book supply of the hot boxes and sell them to the community. Also a complimentary currency system could contain hot boxes as a form of payment for certain jobs. All of these methods would have to be investigated further.

Common questions about the Hot Box are answered in the information brochure on page 19.

www.thehotboxco.co.za

"I'm shocked that such a clever idea hasn't taken off sooner as it is the most innovative and convenient way to cook - and environmentally friendly. So many positives rolled into one clever idea: 'The Hotbox' "

(Madelein Wohler, Noordhoek, Cape Town.)

Hot Box

www.theHOTBOXco.co.za

Redevelopment: Hot Water Bags

Benefits	Eliminates need to heat water on stove for bathing.
How it Works	Solar energy heats water in device.
Used in Community?	Not used
Ways of obtaining	Local camping store/Variety Store
Money Spent	200 rand or less
Money Saved	0.44 rand/day
Problems to Be Considered	Theft, cloudy days

A simple alternative method to heat water is a solar hot water bag. The most popular and obvious use of this method is a solar shower. These are marketed to backpackers and are cheap and simply constructed. The device is a synthetic waterproof and durable black material sewed into a bag with a shower spout on one end and a filling hole on the other. The bag is filled with available water during the day and laid out in the sun. The dark bag absorbs heat from the sunlight and transfers it to the water. After a few hours, the bag is hung in the air and a warm shower is available that required only a cold water source and a few hours in the sun. These solar showers can be purchased in stores for around R200. This simple device could be very easily adapted to life in informal settlements for free heated water.

The solar shower is actually just a solar water heater that can be used for any hot water needs. A thick black plastic bag would be just as efficient at heating water as a solar shower. The shower spout would be unnecessary if the water was only desired for a bath or for cooking with. Heating the bag in the sun, the water would be warm enough to bath e with.

Other measures could be taken to increase the efficiency and performance of the solar bag. The bag could be placed in a solar box or panel cooker to focus the sun's heat on the bag. It could also be placed in a hot box after the sun had gone down to insulate the heated water and store it for hot water after dark.

Social Considerations

When the solar water bag idea was introduced to members of the street committee at the first charette, people were interested and enthusiastic about the idea. It offers a very simple and inexpensive solution to the issue of creating hot water. The idea of a shower bag, however, would likely not be well received. According to studies done for the Kuyasa Project, residents of Kuyasa, which is also located in Khayelitsha, did not like the showers that were installed as part of the SWH programme. Residents feel as though a shower doesn't fully clean them, and that they prefer bathing. This makes the shower spout on most camping bags unnecessary, but heating the bag for bath water is still useful.

The simplicity and low cost of the solar hot water bag is especially appealing. While many new energy saving innovations could be vulnerable to theft and vandalism, the solar hot water bag could be made of such cheap materials that there would be no motivation to steal it.

These concepts could be incorporated into either single family homes, with individuals filling their bag each day from a tap, or it could be a group venture. One local station could fill up many solar bags throughout the day and hand them out to homeowners in need of hot water.

Ways to Provide them to the Community

The solar hot water bag could be sold to the community at a central facility as is described in our section labeled "Alternative Energy Centre." They could be purchased and sold at a slight markup and still be affordable.

A solar hot water bag could also easily be made in Monwabisi Park. Using a thick black plastic bag, only an effective means of sealing off the opening would be required to make an effective way heating water. An asthetically pleasing version of this idea could be created at the energy centre and sold to the community. A way of making them could also be taught to people so that they could make them on their own.

While the solar hot water bag will not revolutionize energy usage in Monwabis Park, it could save people a small amount of money, which would help to ease the burden of energy costs for residents. It also is a way to simply introduce alternative energy sources to people. A low cost solution such as this can be tried by residents without significant investment of time or capital. Ideas like this could stimulate alternative ways of thinking about energy use and promote more sustainable energy sources.

Solar Hot Water Bag

www.sz-wholesale.com/uploadFiles/060328180042s.jpg

Redevelopment: Wind Turbine

Benefits	Reduces amount of electricity needed to purchase.
How it Works	Harnesses wind energy and converts to electricity
Used in Community?	Not used.
Ways of obtaining	Many different companies/could make from 40 gallon drum.
Money Spent	Varies
Money Saved	R 150 / month
Problems to Be Considered	Theft and equality between who uses.

A possible solution for the problems that poor South Africans face in Monwabisi Park and other informal settlements around South Africa is the implementation of wind turbines. Monwabisi Park is not completely electrified and as a result many informal electric lines are run from shack to shack which creates a long list of potential problems for the community. A wind turbine which utilizes the 'free' energy provided by the valuable coastal breezes would eliminate many of the potential problems with electricity in the park. The first problem that wind turbines would aide with would be with the initial task of connecting to the government's electric grid. With a wind turbine the power produced would potentially eliminate the need for electricity from the grid.

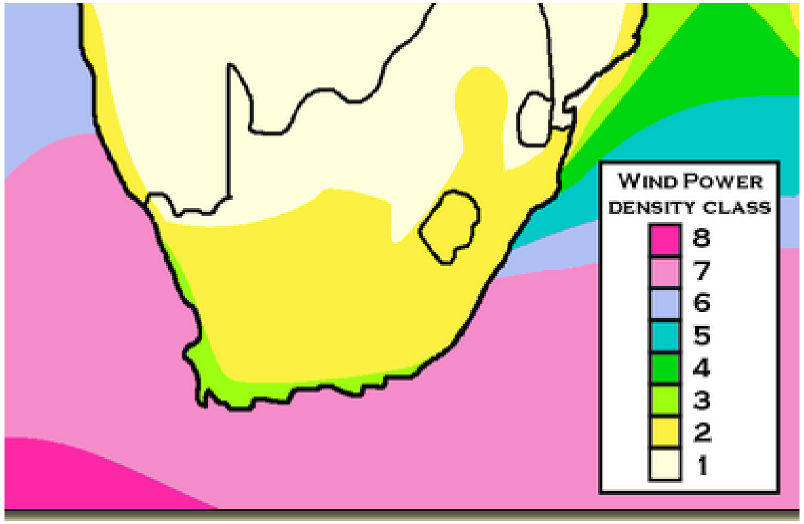


Figure 5-14: Wind Density Map of South Africa. Monwabisi Park is in the medium density green.

We have analyzed the wide range of turbines that could be implemented in the redevelopment of Monwabisi Park. On the lower end of the spectrum, turbines that produce a small amount of energy can be innovative and constructed from recycled oil drums for little to no cost and such wind mills could power an individual home. In this scheme, the drum is cut in half and fitted back together in a manner that catches the wind effectively. (Figure 5-15)

As stated before, the easiest way of obtaining a wind turbine is to construct your own from recycled or purchased materials. During our interviews and surveys, the trend was that the community liked using recycled materials for building because of its practicality. However, through our interviews and walks through the community we discovered that there are no wind turbines present in the park. Interest in wind turbines has been shown in the park and has been seen in surrounding areas such as the Sustainability Institute,[a] which utilizes a wind turbine to power a pump that is part of a filtration system

Figure 5-15: Oil Drum Vertical Axis Wind Turbine

On the higher end of the spectrum, turbines that produce 20kW of energy can be purchased from a company such as the GW Store for roughly R190000 and would supply energy for multiple homes and facilities.[k] There must be a middle ground for the wind turbines used in Monwabisi Park because through our research we have found that the higher end of the wind turbines may not be suited for application in the park and the lower end may not suffice an individual home's energy demands. From Figure 5-5 it is seen that the energy demands of a typical home depends directly on what appliances are used in the home and how long they are used each day.

If a homeowner uses an electric stove, electric light, and a radio, 1.6kW will be required to power all of those devices. This means that a wind turbine of at least 3kW will be required to power those appliances because the rating of a turbine is usually only under ideal wind conditions. A 3kW wind turbine will cost about R50000 which is a sizable investment but the benefits gained from it will outweigh having to pay for the initial cost. This middle size turbine would probably be ideal for Monwabisi Park; however it is not a good technology for individual application within the park.

We would like a wind turbine that can provide the energy needs for a number of residents and not just one home because the redevelopment plans are for the community as a whole. Limiting what appliances a homeowner can use when drawing energy from the wind turbine might be a way to supply a larger number of homes with power. Since there will be a wind turbine incorporated into the Alternative Energy Centre the turbine could power the entire centre and potentially other surrounding commercial facilities and homes. Figure 5-16 shows that a 3Kw turbine could provide electricity to one home which uses all the appliances from the previous example, but a 20Kw turbine will provide energy to six times the amount of homes.

The amount of homes that can be powered by the wind turbines depends on what appliances are used in the home. If homeowners use the grid for the high wattage cooking appliances such as an electric stove which requires 1500watts to operate, and the wind turbine power for all of their smaller appliances such as refrigerators which require 226watts, then more homes could benefit from the wind turbines' free energy. If the wind turbine acted as the power supply for multiple homes each home could have a different set of outlets for their electrical appliances. These outlets would consist of one set that is electricity from the grid, for higher wattage appliances, and the other set that is electricity from the wind turbine, for lower wattage appliances. To make sure that everyone gets equal amounts of electricity, the electricity will be converted to a wattage which will be equal amongst the homes receiving the electricity. We recommend that the wattage be no more than 500watts because in a typical home the only appliance that exceeds this is the electric stove and we want the homeowner to use the grid for high wattage appliances such as that. Limiting the wattage provided to each home will prevent any individuals trying to get more electricity for free as well as prevent any jealousies and problems from occurring between individuals. If wind turbines were implemented throughout Monwabisi Park more homes could benefit from the free energy provided by the coastal winds and wind turbines resulting in a better and more sustainable livelihood for Monwabisi Park residents.

Wind Turbine	Energy Produced	House Equivalent	Cost
Aeolus	3Kw	1	R42,028.08
GW	20Kw	6	R190,385.66

Figure 5-16: Chart showing the cost and the number of homes that two different sized wind turbines would cover.

KESTREL E400i (3 kW)

Rated output = 3000 W
Rated wind speed = 12.5 m/s (45 km/h)
Min. Wind Speed = 2.8 m/s (10 Km/h)
Rotor Diameter = 4m
Tower Height = 12-15m
Tower Top Mass = 150 kg
Annual Output in Cape Town = approx. 3000 kWh

While they are more expensive than vertical axis wind turbines, horizontal axis rotor types like this model are much more efficient and can generate more power. If money was available for the investment, a model such as this could be used to provide power for a community building. This electrical supply could be in addition to the grid power supply or to other alternative energy sources such as solar panels.

www.kestrelwind.co.za

Energy Information Program (Brochure Cover)

Alternative Energy Suggestions

Through careful examination of the current energy uses in Monwabisi Park we, the WPI Energy Services project group, would like to provide some ideas that could possibly save the people of this community money, as well as reduce their energy demands. These are immediate solutions that we feel would be most beneficial to the community's current living situation.

Cooking Alternative

Hot Boxes could save hundreds of rand per year in cooking costs by reducing stove usage.

Electricity Conservation

Being mindful of electricity usage and conservation could show many benefits.

Hot Water Alternative

Using the stove to heat water for bathing could be eliminated with the use of solar hot water bags

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Environmental Resource Management

WPI

Cape Town B'08

Worcester Polytechnic Institute

Interactive Qualifying Project
Cape Town B'08
Energy Services
Indlovu Project: Monwabisi Park

E-mail: CT08Energy@wpi.edu

Worcester Polytechnic Institute

Alternative Energy Information

The benefits of utilizing alternative energy in an informal settlement

Monwabisi Park
Indlovu Project

Energy Information Program (Brochure Inside)

Proposed Solution: **Hot Box**

Money Saved: 438 rand/year
Money Spent: 200 rand

How it Works:
"Insulated Cooking." Keep the heat in that is used to cook food and no replacement heat is needed to complete the cooking process.

Does it really cook my food?
Yes! To truly benefit from the Hot Box a subtle thinking shift is needed but once the benefits are seen its hard to change back to the conventional cooking methods.

What type of pot do you use in the Hot Box?
Any pot you currently use to cook with that fits inside of the hot box will work fine.

Do you need to heat the Hot Box?
No! Keep the Hot Box away from heat and fire.

What type of meals can be cooked?
- Beans, Legumes, Grains, Pulses
- Soups, Stews, Casseroles
- Steamed Vegetables
- Rice, Pasta, Mieliepap, Samp

Where to Purchase:

Claremont: Wellness Warehouse Cavendish
(021) 673 7200
Kloof Street: Wellness Warehouse Kloof
(021) 464 5142
Diep River: Cristy's Sports
(021) 715 5020
Tokai: Sustainable Living Centre - West Lake
(021) 701 2029
Muizenberg: Nin's
(021) 788 9599

www.theHOTBOXco.co.za

Proposed Solution: **Electricity Conservation**

Money Saved: 255 rand/year
Money Spent: None

How it Works:
"Electricity Conservation." Using electrical appliances less decreases your electricity costs monthly.

Does it really save me money?
Yes! An electrical appliance that runs for 1/2 of the time costs 1/2 as much money. Using your television for 2 hours instead of 4 hours a day will save you 5.30 rand per month.

Do I need to use everything less to save money?
No. Even using one appliance less will be beneficial in the long run. The more appliance usages are reduced, the more money will be saved in the long run.

Does the type of light bulb I use effect the amount of money I pay for electricity?
Yes! You can save 3.5 rand per month using a 11W CFL light bulb instead of older incandescent light bulbs.

Appliance	Old Hours Used / Day	New Hours Used / Day	Old Monthly Cost	New Monthly Cost	Savings
Electric Stove	3	2.5	R 79.55	R 66.29	R 13.26
Television	4	3	R 10.61	R 7.96	R 2.65
Stereo	6	4	R 5.30	R 3.54	R 1.77
11 Watt CFL	4	4	R 4.24	R 0.78	R 3.46
			R 99.71	R 78.56	R 21.14

Proposed Solution: **Solar Hot Water Bag**

Money Saved: 160 rand/year
Money Spent: 150-250 rand

How it Works:
"Solar Heating." Use the sun's energy to heat water in a black bag which can be used for bathing.

Does it really heat my water?
Yes! Place water in the bag on a sunny day and in roughly 2 hours the water will be warm enough to bathe with.

Do you need to heat the Solar Hot Water Bag?
No! The sun does all of the heating, keep away from heat and fire.

Do I need to add anything special to the water?
No. Water right from the tap can be poured into the bag and left outdoors.

Does it work on a cloudy day?
No. On cloudy days you will need to heat the water on the stove in order to bathe.

Where to Purchase:
Camping Supply Stores

Bellville:
Cape Union Mart- (021) 914 1441
Outdoor Warehouse- (021) 948 6221

Hout Bay:
Mountain Mail Order- (021) 790 6026

Cape Town:
Christie Sports Outdoor Centre- (021) 712 5078

Alternative Energy Centre

In a community such as Monwabisi Park, where there is a great need for new energy ideas, there needs to be an effective way of providing information, supplies, and services to the people. One way of doing this would be to have a central facility, employing trained community members, where people can come to learn about different energy ideas, and to purchase necessary supplies or technologies to meet their own energy needs.

Integrated Energy Centres

An idea such as this has already been tried by the Department of Minerals and Energy. Called Integrated Energy Centres (IeCs), these facilities are one-stop shops for a community's energy needs. They sell basic energy products, including petrol, LP gas, paraffin, and candles. They function as a community coop, employing between 5 and 10 full time workers.

The products sold at the IeC are bought directly from suppliers, eliminating the middle man, and driving down costs for the community. As well as providing cheap products, a core goal of the IeC is to provide important information about energy practices. IeC employees provide training to consumers about safe use of paraffin and LPG. Paraffin is also sold in regulated safe containers to ensure safety.

Alternative Energy Centre

We would like to propose the creation of a facility that provides a similar service as the Integrated Energy Centre, but with a focus on sustainable alternatives to current energy use. As the community currently uses electricity, paraffin, and LP gas to cook and heat with, information and training on how to properly use these energy sources would be essential to the energy centre. One or more "energy specialists" would need to be trained to understand both new innovations in energy usage, but also the safe use of current practices. While new energy ideas need to be encouraged, current practices must be respected, and efforts to provide information on safe practices are essential to the community.

The energy specialist will also be educated about various alternative energy sources. He or she will be equipped with information on hot boxes, solar hot water bags, and wind turbines. Knowing about these technologies, and working at a central facility, s/he will have the ability to interact with many members of the community and influence residents' energy practices.

The alternative energy centre would also provide actual products for the community. It could stock alternative fuels to paraffin, such as LP gas, or ethanol gel, which is a much safer and more efficient cooking fuel. The centre could also sell Hot Boxes to residents. To ease suspicions of Hot Boxes not cooking food properly, the AEC could have demonstrations periodically that show the Hot Box working, and allowing people to try food cooked the Hot Box.

This facility would also be where people could have an electricity audit preformed. The employees would be trained and supplied with calculators and information necessary to perform an accurate assessment of a household's electricity usage.

This facility could also be combined with a centralized hot water facility in order to provide even more service to the community from a single location.

An alternative energy centre would create job opportunities, increase the sustainability of the community, while promoting communal values.

Requirements for Centralized Hot Water

- Multiple Solar Water Heaters
- Roof Space for SWHS
- Piped water supply for SWHs
- Plumbing to run water to faucet
- Bucket sleeves to insulate hot water
- Employee to distribute hot water

Caba Mdeni Integrated Energy Centre

Located in the Magadla village in the Eastern Cape, Caba Mdeni IeC was created on 4 December 2004. Since October of 2005, the IeC has been able to support the salaries of its 10 full time employees through sales revenue.

Services provided include:

- Petrol
- Diesel
- LP Gas
- Candles
- Clean bottled Paraffin
- lubricants and Beverages

Methodology

1. Interview with Di Womersley

10/28/08

This day was our first trip to Monwabisi Park. We sat down and had a conversation with Di Wormersley, a member of the NGO "Shaster Foundation", who told us general facts about Monwabisi Park and the Indlovu Project. Di is very influential in the Indlovu Project and she has helped us with gathering information for our project. She does not live in Monwabisi Park, so we often verified the information she told us with members of the community. She has taken a stance of working to help the community without any influence or aid from any governmental or political bodies. Seeing as we are working with various city agencies, Di would provide a valuable perspective as someone who works separately from the city. This initial interview gave us information to help focus our project and helped us decide on questions that we wanted to ask Buyiswa and the co-researchers. She was most interested in small-scale solutions which could potentially be put into practice immediately. It was a good base interview and the facts are verified in future interviews/ surveys.

2. Tour of C Section with Yolisile, Luzoku and Anele

10/28/08

The second part of our first day in the park was a tour of the park with some of the co researchers. We started at the Indlovu Centre, viewing several water taps and toilets, and also observing the outsides of many homes and the electrical wires hanging all over. The focus of this trip was to get a first impression of the area and to ask many questions to our guides. We also traveled to Yolisile's home and were able to view some of the energy devices and appliances. This was a very informative view into an average home and also a chance to photograph common cooking and heating devices.

An important result of this trip with the coresearchers was our chance to become familiar with interacting with them. Conversation was difficult at first. There was a significant language barrier, and questions were often not understood. We and the coresearchers both adapted quickly though, and learned ways to rephrase and clarify questions.

This trip was a good chance for us to get a lot of questions answered quickly. Much of the data we learned during this time was repeated or corrected later, but it was more important for us to gain the experience in communication and to get a good view of the park from the ground.

Perhaps most importantly, we were able to start to form relationships with the coresearchers. They did not know what to expect from working with us, and it was important that we make a good first impression. We worked with the coresearchers for the duration of our research, and the friendships we formed were essential to the success of our project. Future interviews were much more relaxed and allowed us to gather more specific information.

3. Interview with Buyiswa and Coresearchers

10/30/08

During this trip to Monwabisi Park we set up a meeting with the six co-researchers and Buyiswa, the woman who helps run the Indlovu Center, who we have been working with during our time in the park. We met with the co-researchers and Buyiswa in the Youth Centre to discuss the energy services utilized by people in Monwabisi Park.

This was our first formal introduction to Buyiswa, who would be a pivotal resource to our project. She is seen as a community leader, and understands the subtleties of working with the community. As the member of the community who works most closely with Di Womersley, she has become very interested in ideas of alternative and sustainable energy. She has insight into the sentiment of the community, and is able to tell us how she thinks our ideas will be received, and about different problems we will encounter.

Meeting with all the coresearchers at once also gave us a chance to gather data about current conditions and have it verified by a group of 6, instead of just an individual.

With the informal interviewing format we were using, we were able to casually converse about different energy service issues and gather much more in-depth information than we would be able to gather using door to door surveying.

4. Surveying Residents

10/31/08

The most quantitative data we were able to collect came from traveling from house to house and asking a series of survey questions to the residents. On the first day, Sept 31, we were exposed to our first opportunity to question various community members. Accompanied by two of our coresearchers, we were taken throughout C section. We found that some of the residents could understand and speak English, and those who couldn't were translated by our coresearchers. Questions at first were basic, such as how much electricity do you use, and how much do you pay for it? On the first day we were able to get a preliminary sense of how much people spend on electricity, and what they use it for. It also allowed us to see how questions must be asked. We were interested in what people used for insulating their shacks, but found that people weren't familiar with the term "insulation."

Methodology

4. Surveying Residents Continued

10/31/08

On the other two days we surveyed residents we first met with coresearchers to go over a set of prepared questions. This ensured that the coresearchers fully understood what information we were looking for, so they could help us to learn from the residents with whom we could not communicate directly.

We found that residents showed different levels of enthusiasm when answering our questions. Some residents seemed eager to answer our questions and openly conversed with us regarding electricity issues, while others were more reserved. A woman we interviewed told us “I hope you are not just interviewing us and then not doing anything.” Some of the residents of Monwabisi feel as if they are made many empty promises. We had to be aware of this and be clear of our intentions as students doing research with the end goal of making recommendations. We also had to be respectful of people who were not willing to openly share their feelings.

After we went on our three trips to survey residents, we had collected a small, but consistent set of data regarding electricity practices. We surveyed residents from C1, who all had access to a prepayment meter, as well as residents of C2, who had to share a prepayment meter or used no electricity at all. Along with the quantitative data we collected regarding electricity use, we were also able to gather qualitative data from some residents regarding their concerns with electricity. We made sure to give the interviewee a chance to voice any concerns they had, or just add anything they would like to say. Hearing the concerns of various individuals gave us a good sense of community opinion regarding electricity issues. Overall, the survey data gave us confirmation of community-wide electricity use and community concerns regarding electricity. We could use that data in conjunction with the more detailed and specific information we gathered from interviews with the coresearchers to better understand the current energy situation in Monwabisi Park.

5. Interview with Wouter Roggen RE: Kuyasa Programme

11/12/2008

Jenny Josefson, an intern of Jaques DuToit of the Sustainable Livelihoods branch of the Environmental Resource management Department was able to get us in contact with Wouter Roggen, who has been working with the Kuyasa Programme for the last few years. We met with him for an hour in hopes of learning about the successes and failures of implementing the Kuyasa Programme. We found, however, that he had not been involved in the actual initial testing phase of the Kuyasa Programme, which occurred years before he joined with the project. He was instead able to inform us about the complexities of organizing funding for a large-scale project. Mr. Roggen provided insight into the financial difficulties a plan for large-scale future redevelopment in Monwabisi Park would run into.

Our interview was conducted in a much more structured and formal way than with the coresearchers. Mr. Roggen could only meet with us for an hour, so our questions had to be concise and organized. We made sure to have an excess of questions so we could adapt the interview to focus on Mr. Roggen’s expertise. The interview provided us with a large amount of information in a short period of time, and allowed us to ask specific questions about the programme from someone who actually worked on it.

6. Interview with Cornelia

11/25/08

In an effort to have a complete energy profile of one of the residents of the initial burn site, we sat down with Cornelia in her home behind the Indlovu Centre. We were put in contact with her through Buyiswa. As opposed to our earlier interviews with people, where we were looking for a general idea of the energy services people use, we wanted to know all the details of energy use in Cornelia’s home. The level of detail we wanted made for a much longer and in-depth interview. Buyiswa told us that Cornelia speaks English well and would be willing to talk with us. This receptivity was critical, as we wouldn’t have wanted to impose on someone who was not interested in sharing information with us. Cornelia was very open and very willing to go into the type of specific data we needed.

We also presented her with a hot box for her cooking. She had used her own hot box before it burned in the fire. We presented her with the box to borrow, and asked her to fill out a simple form documenting cooking times to find energy savings. She agreed, and we picked up the cooker and the forms a week later.

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