ESMAP
Energy Sector Management Assistance Program

Energy Efficient Cities Initiative

GOOD PRACTICES IN CITY ENERGY EFFICIENCY

Cape Town-Kuyasa Settlement, South Africa- Low-Income Energy Efficiency Housing Project

Project title	Kuyasa Low-Income Energy Efficiency Housing Project
Sector	Residential Buildings
Type of project	Energy Efficiency Building Retrofit
City and country	Cape Town, South Africa
City population	3.4 million (2010)
Total budget	US$4.67 million (R33 million)
Annual % energy reduction	7.40 million KWh (34%)
Project status	Completed

Project Summary:

The Kuyasa project is an energy efficiency (EE) retrofit initiative launched in 1999 for 2,309 low-income houses in the outskirts of Cape Town, South Africa. Through the installation of solar water heaters (SWHs), ceiling insulation, and compact fluorescent lamps (CFLs), the project has been able to save 7.40 million kWh (34 percent) and 6,437 tons of CO_2 emissions (33 percent) on an annual basis—representing an aggregated savings of 155 million kWh and 135,187 tons of CO_2 emissions. Further, the insulated ceilings resulted in improved thermal comfort and improved indoor quality inside the houses as residents were able to almost eliminate the need for paraffin oil heaters. Residents reported cost savings from reduced paraffin and electricity use. The project partners actively engaged the Kuyasa residents for implementation of the retrofits and, as a result, the community benefitted immensely through technical training and capacity building for residents, job creation and an enhanced sense of ownership and responsibility.

The project planning effort took three years (1999-2002) and was a collaborative effort of the City of Cape Town, a Dutch nongovernmental organization SouthSouthNorth (SSN), and the residents of Kuyasa. The project model was piloted in ten houses and the successful implementation of the pilot project was used to register the project as a Clean Development Mechanism (CDM) with the United Nations Framework Convention on Climate Change (UNFCCC). The project had a total budget of US$4.67 million (R33 million) allocated to the installation of the SWHs (45 percent), ceiling insulation (46 percent), and CFLs (9 percent).[1] The majority of the funds for the project came from financial grants from the multiple government entities. The main source of revenue for the project was the sale of Certified Emission Reduction (CER) credits under CDM, which will generate a total of US$3.08 million (R21.8 million) over the 21-year crediting period for the project. The residents of Kuyasa also made small monthly contributions (US$0.35; R30) towards the project over a three-year period—totaling US$0.35 million (R2.49 million).

The Kuyasa project demonstrates how EE interventions in low-income communities can be successfully implemented and result in the alleviation of complex problems such as poverty, economic growth, unemployment, increase in energy access and supply, and environmental sustainability. The project also demonstrates how an international mechanism such as the CDM is a viable mechanism that can be leveraged for poverty alleviation and sustainable development. This project represented the first CDM project within South Africa and the first

[1] US$1.00 = 7.07 South African Rand (R): Ten year average rate from 2000-2010.

Gold Standard CDM project worldwide.[2] The successful implementation of the project has encouraged the project partners to focus on expanding the scale of this project and work towards development of a sustainable financial model for similar projects in the future.

1. Introduction

This project was implemented in *Khayelitsha*, a suburb of Cape Town, South Africa. The city of Cape Town is positioned on the southern peninsula of the Western Cape Province covering a geographical area of 2,479 square kilometers (957.15 sq mi) and serves as the province's capital city. With a total population of 3.4 million people (2010), it is the second most populous city in South Africa and the provincial and legislative capital of the country. Cape Town is South Africa's second richest city, in terms of gross domestic product (GDP) per capita, after Johannesburg. In 2009 Cape Town's real GDP was US$26.6 billion (R188.46 billion) and a per capita income of US$7,840 (R55,428). As the province's economic hub, it produces 10.6 percent of South Africa's GDP and accounts for almost 71 percent of the Western Cape's economic activity. The main drivers of economic growth are finance and business services, manufacturing, and wholesale and retail trade sectors.

Although South Africa is viewed economically as a developing country, it is a significant carbon polluter and emitter of greenhouse gases (GHGs), mainly due to its coal-fired electricity generation facilities and large industries. The country is 13th on the GHG emitters list, with emissions of 9.25 tons per capita and a total contribution of over 451 Mt/year.[3] The country also faces challenges: (i) providing energy to its poorer citizens; (ii) meeting energy demand with recent energy shortages; and (ii) supplying affordable housing in its cities. Since 1994, the African National Congress (ANC)-led democratic government in South Africa has promised its citizens a "better life for all," including adequate housing, access to water, electricity, sanitation, education, health care, decent transportation, and economic opportunities. Although significant progress has been made in redressing the inequalities of the past, significant backlogs still exist in terms of adequate housing and access to energy. Cape Town's housing shortage of approximately 400,000 units has been noted as the city's most serious developmental challenge.[4]

Before 1994, the apartheid government dictated that black people have a 'homeland' where they would own land and houses, and would only temporarily live in Cape Town to provide labor to white-owned businesses. In 1983, the government moved all black people who had been living in and around Cape Town to a new township, called Khayelitsha, which means *"New Home"* in isiXhosa, the dominant language in the Eastern Cape Province. Kuyasa is a low-income formal housing settlement in Khayelitsha, located approximately 30 km south-east of the Cape Town, covering 52.5 km^2. Khayelitsha was one of the government subsidized projects developed by the Reconstruction and Development Program (RDP) to address the low-income housing shortage.[5] This program included the building of one million houses by

[2] The Gold Standard is an independently audited, globally applicable best practice methodology for project development that delivers high quality carbon credits of premium value along with sustainable development co-benefits associated with the projects. Created in 2003 by a small group of NGOs, today the label receives worldwide recognition and is supported by 51 charities, NGOs and environmental and development organizations.

[3] US Energy Information Administration (EIA) 2008.

[4] City of Cape Town (2008).

[5] The RDP is a South African socio-economic policy framework implemented by the ANC government of Nelson Mandela in 1994. The main goal of the RDP is to alleviate poverty and address the massive shortfalls in social services across the country, by combining fiscal measures to boost the economy with social service provisions and infrastructural

the year 2000 for all families with a monthly income of less than US$495 (R3,500), that had never owned property before, and resided in squatter camps close to urban areas. Within RDP, an institutional subsidy of US$2,263 (R16, 000) per beneficiary was allocated for the building of standard RDP housing units with a total area of 30 m^2. While the township was originally planned to accommodate 250,000 residents, the national census of 2001 suggested that approximately 400,000 people live in Khayelitsha—creating a population density of 7,748 inhabitants per km.[2] Most residents claim origin from, or close family ties with, the Eastern Cape Province of South Africa, one of the poorest regions of the country that borders the Western Cape Province.

Over the past 15 years, millions of poor citizens have received government-subsidized housing in South Africa. Each 30 m^2 housing unit provided by the government in Kuyasa was electrified with a single power supply point on a prepaid electricity meter but had no internal wiring, no insulation, and no water heaters/geysers. Lighting was provided by incandescent bulbs on 'do-it-yourself' wiring. These houses have electricity but no hot water storage geysers (providing hot water on demand) or ceiling insulation. The units are dependent on batch heating for hot water (i.e., pots on paraffin stoves) and inefficient methods for space heating during the four-month winter season. Overall, the quality and EE of these structures is low and subject to criticism, and the occupants report a disproportionate financial and health burden directly linked to poor thermal efficiency.

2. Project Description and Design

The project was a City of Cape Town initiative in collaboration with the community of Kuyasa and the Dutch nongovernmental organization (NGO) partner SouthSouthNorth (SSN).[6] The local government of Cape Town is the project owner, the main coordinating body and the implementing party for this project (via subcontractors). The municipal departments involved in the project are the Department of Environmental Affairs and Tourism (DEAT) and the South African Export Development Fund (SAEDF). SSN covered the costs related to the project design and savings validation required to register the project under the Clean Development Mechanism (CDM).

The goals of the Kuyasa retrofit project were to improve the living conditions of the low-income inhabitants of Kuyasa while reducing fossil fuel-based energy, energy costs and CO_2 emissions. This would be achieved with three main interventions:

1. Improving the thermal performance of low-income housing units;
2. Providing energy efficient lighting to these households; and
3. Improving water heating efficiency through solar water heaters (SWHs).

The project initiation can be traced back to the personal interest of Steve Thorne, an environmental scientist working at SSN, who was passionate about removing EE market barriers for low-income communities in Africa using CDM at a project level. Thorne's leadership found support of colleagues at the NGO and also generated interest with key Kuyasa residents who agreed to provide them access to the Kuyasa residents and site. The community involvement and complete access to the area of the recently developed Kuyasa

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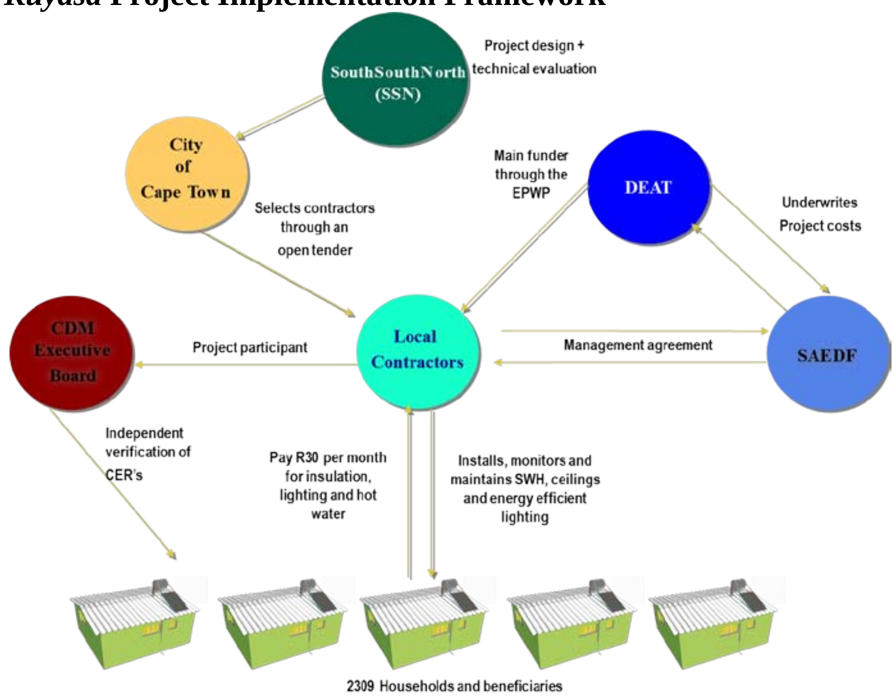
project development. More for information see http://www.nelsonmandela.org/omalley/index.php/site/q/03lv02039/04lv02103/05lv02120/06lv02126.htm.

[6] SouthSouthNorth (SSN) is a Dutch network-based non-profit organization sharing two decades of experience in the fields of climate change and social development. SSN pursues poverty reduction in Sub Saharan Africa, Asia and Latin America by building Southern capacity and delivering community-based mitigation and adaptation projects.

RDP housing scheme made it an ideal site for conducting the measurement and verifications needed for a CDM project. From 1999 to 2002, Thorne and the SSN team developed the Kuyasa CDM project concept and presented it to the community via town-hall meetings. In May 2003, SSN appointed AGAMA Energy to conduct pilot studies with ten houses to prepare the baseline documents, which were then submitted to the United Nations Framework Convention on Climate Change (UNFCCC) for registration. The project was formally registered as a CDM project in August 2005, after additional activities were completed. These activities included a period for public comment, document revisions, interviews and site visits. SAEDF was appointed the main implementer of the project and local contractors were selected by the City/SAEDF to oversee the EE retrofits and the monitoring and maintenance of the SWHs, ceilings with insulation, and efficient lighting (using compact fluorescent lamps or CFLs) in existing low-income RDP households in Kuyasa.

Figure 1: *Kuyasa* Project Implementation Framework



Source: UNDP (2010).

In addition to the energy security and climate issues, the project provided another benefit related to addressing "suppressed demand" for energy services, a goal of the City. The City was committed to improving access to energy in communities where energy services were inadequate due to poverty and/or lack of infrastructure. By making changes in the energy use and demand patterns with efficient technologies and renewable energy, the project sought to provide energy access to the poor. The application of the suppressed demand for energy through the Kuyasa project is a demonstration of a unique interpretation of the CDM methodology. The Kuyasa project was aimed at improving the quality of life of the residents, which was expected to result in increased energy consumption (and thus carbon emissions). However, the rules compiled by UNFCCC were interpreted in a way to allow for the crediting of GHG reductions against a baseline that is equivalent to a projected level of energy service (a warm house, sufficient warm water and light) rather than the current level of energy poverty, characterized by suppressed demand for energy services. As a result, rather than waiting for these households to become 'dirty' as a result of increased energy consumption before they qualify to get "clean," they are "leap-frogged" to the cleaner technologies through the CDM mechanism, thus linking climate change to poverty alleviation.

Below are the details of the three EE measures under the project:

1. *Improvement of thermal performance*

The existing low-cost households in Kuyasa lacked insulated ceilings. The project planned to retrofit them with 25 mm IsoBoard thermal insulation (0.024 Kelvin/Watt Degree Celsius- K/WºC) to make households more comfortable year-round and to reduce demand for fuel sources used for space heating purposes. Thermal modeling of ten houses in Kuyasa was conducted to establish the baseline, estimate the improved thermal comfort levels (defined at 21º C or 70º F), estimate energy consumption levels for space heating, and other associated benefits from the insulation. The project utilized the QUICK (Version 3.0) thermal modeling software to simulate the thermal performance of the households and the sensitivity of these units to thermal performance interventions such as ceilings.[7] The project activity emission reductions were calculated based on actual energy use for space heating and the energy model was used to calculate the amount of energy it would have taken for equivalent heating in a home without an insulated ceiling.

2. *Provision of energy efficient lighting*

The lighting retrofit involved replacing incandescent bulbs with CFLs in each household. In each home, two 60W incandescent lamps were replaced by two CFLs (11W and 16W). In the sampled households studied to develop the baseline, data was analyzed on which two lights were in use the most in order to target them under the project. Survey data in the baseline study showed that the average daily operating time of the lamps was 6.8 hours. It was expected that including CFLs in the project would make a significant contribution to the reduction of CO_2 emissions, result in cost savings to the household, and reduce the utility's peak demand. Maintenance and proper care (during monitoring periods) was planned to ensure continued use and replacement of the CFLs within the project period. In addition, the project provided the residents with improved and safe electric wiring and electric outlets for usage in their homes.

3. *Improvement in water heating efficiency through SWHs*

The project also planned to equip each house with SWHs with a collector area of 1.4 square meters (15.07 square feet) and a hot water storage tank of 100 liters (22.7 gallons). The design specifications of the SWHs, such as the collector area, storage capacity, azimuth and tilt angles, etc., were finalized through a numerical modeling exercise commissioned by SSN. The SWHs were installed with timers to respond to the heating load peaks in the evenings in winter. The project initially used imported "Genergy" evacuated tube SWHs, but later switched to locally-manufactured open-vented SWHs by "XStream" which provided similar or improved performance.

South African contractors were selected through an open tender to install the EE measures. These local contractors, along with other local residents, were trained as plumbers and electricians to install and provide maintenance services for these measures. This ensured that the SWH collectors were able to draw as much sunlight as possible). Homeowners, particularly women, were informed and trained about the installed efficiency measures, performance details of the SWHs, and their use and maintenance. A small monthly monetary contribution made by homeowners for a three-year period was deemed critical to ensure

[7] The QUICK thermal modeling software has been repackaged as NewQUICK, see www.newquick.com.

community buy-in and to instill a sense of ownership amongst the homeowners. The money will be paid to SAEDF and will be used to cover the ongoing maintenance costs and possibly towards repayment of the SAEDF loan repayment. By April 2010, the EE retrofits for all 2,309 houses within the project area were completed.

Figure 2: Kuyasa Low-Income Housing - Installation of EE Measures

Source: Kuyasa CDM Project Website (http://www.kuyasacdm.co.za/index.php).

Approximately, 30 percent of the project costs went to support local job creation and skills development. Unemployed residents within Kuyasa were recruited and trained in carpentry, plumbing and electrical skills. The training was a combination of: (i) in-house skills transfer, where a technical expert would spend a week with the local team until they were able to complete all aspects of the installations; and (ii) outsourced accredited training which gave residents a certificate in their specific skills. In addition to the installation training, the project provided training to one person from each household in Kuyasa to cover the usage and safety of the SWHs and CFLs, as well as employment-focused life skills, such as hospitality and cleaning, first-aid, and emergency services skills.

The biggest challenge for this project was securing the financing to cover the capital costs of the technologies. SSN, in collaboration with the city of Cape Town, had decided to explore the CDM mechanism as a potential source of funding for this project. However, in spite of the project's registration as a CDM project, it was understood that there would be no additional source of revenue for this project and the money generated through the sale of certified emission reduction (CER) credits would not be available to cover the upfront capital costs for this project. From 1999-2002, the SSN team developed the Kuyasa CDM project concept and sought community buy-in. The project team struggled initially to generate the motivation and interest among local residents regarding. After extended outreach and a long-term engagement with the community, SSN and the city were able to engage trust and ownership of residents. However, CDM funding was still not adequate to cover the entire project costs. Thus, long and sustained stakeholder engagement efforts were initiated by the SSN team and, after lengthy negotiations, a viable financing solution that included financial grants and loans provided by multiple stakeholders interested in promoting EE in low-income populations in South Africa.

3. Cost, Financing, Benefits, and Effects

The project had a total budget of around US$4.67 million (R33 million) allocated to the installation of the SWHs (45 percent), ceiling insulation (46 percent), and CFLs (9 percent). These allocations included equipment, materials, labor and training costs of the project. The majority of the project funding of US$3.39 million (R24 million) were secured as grants from DEAT, by positioning the project as part of the National Government's Expanded Public Works Program (EPWP) to create employment. Since DEAT was responsible for directing EPWP funding towards environmental projects, they invited proposals from interested projects and organizations. The Western Cape Provincial Department of Housing later contributed ~US$0.57 million (R4 million). These contributions, however, were still inadequate to cover all expenses. Finally, SAEDF offered to underwrite any cost over the DEAT grant funds and recover it over time in future income from residents and carbon credits (~ US$0.71 million, R5 million).

Table 1: Kuyasa Energy Efficiency Project: Capital Costs and Funding Partners

PROJECT FUNDER	US$ (million)	R (million)
Department of Environmental Affairs and Tourism (DEAT) Grant	3.39	24.0
Western Cape Provincial Department of Housing Grant	0.57	4.0
South African Export Development Fund (SAEDF) Loan	0.71	5.0
Total Project Budget	4.67	33.0

Source: UNDP (2010).

The project was not envisioned to generate income or have a positive financial return on investment, although some revenues were generated. In terms of CER income, the project is projected to generate US$147,100 (R1.04 million) [8] on an annual basis, translating to a total of US$3.08 million (R21.8 million) over the 21-year crediting period for the project. [9] This money will be used to cover the SAEDF loan repayment, ongoing maintenance, CDM monitoring, and possibly further replication. Further, a small monthly contribution of US$4.24 (R30) was negotiated between SAEDF and the homeowners for a period of three years (total US$0.35 million; R2.49 million). This money will be collected by SAEDF and will be used for ongoing maintenance costs (primarily for the SWHs) and possibly towards the loan repayment to SAEDF.

Thus, while the project appears to have a shortfall of US$1.23 million (R8.71 million) or an internal rate of return (IRR) of -12 percent in financial terms, the city believes that the economic returns far exceed the financial costs in terms of the considerable social, environmental, health and community benefits for the residents of Kuyasa. After repayment of the loan and the maintenance costs for the technologies, the money generated from this project will be used to scale up the pioneering model tested in Kuyasa in other low-income settlements.

[8] Carbon price of €15 (US$19.98).

[9] The crediting period for a CDM project activity is the period for which reductions from the baseline are verified and certified by a designated operational entity for the purpose of issuance of CERs. The project partners agreed to a maximum timeframe of 21 years as the crediting period for this project. The crediting period began in June 2005 and will have the option of 2 renewable periods- a total of 21 years.

Energy Savings: The CDM monitoring and verification results from November 2010 reveal that the project resulted in annual reductions in energy, 7.40 million kWh (34 percent), and CO_2 emissions, 6,437 tons (33 percent), for the 2,309 households. These numbers are based on the suppressed demand calculation methodology, but still contribute to the deferring of new electricity general capacity investments and reduction in the peak demand for the local utility. This represents an aggregated reduction of 155 million kWh of energy use and 135,187 tons of CO_2 emissions (~ 2.80 tons per household). Additionally, as a result of this project, the local residents of Kuyasa have increased awareness about the value and benefits of EE and renewable technologies.

Table 1: Energy and Carbon Emission Reductions

ENERGY EFFICIENT TECHNOLOGY	BASELINE ESTIMATES		PROJECT ESTIMATES		SAVINGS	
	ENERGY USE (kWh/hh/yr)	EMISSIONS (t CO_2/hh/yr)	ENERGY USE (kWh/hh/yr)	EMISSIONS (t CO_2/hh/yr)	ENERGY USE (kWh/hh/yr)	EMISSIONS (t CO_2/hh/yr)
Insulated Ceilings	7710.0	6.86	6213.48	5.53	1496.52 (19%)	1.33 (19%)
SWHs	1447.0	1.23	0.00	0	1447 (100%)	1.23 (100%)
CFLs	331.0	0.294	74.16	0.066	256.84 (78%)	0.23 (78%)
Total (Per Household)	9488.0	8.384	6287.64	5.596	3200.36 (34%)	2.8 (33%)
Total Number of Houses	2,309					
Total Annual Emission Reductions	6437.49 Tons CO_2					
Total Annual Energy Reductions	7.40 Million Kwh					
21 Year Emission Reduction	135187.33 Tons CO_2					
21 Year Energy reductions	155 Million Kwh					

Source: UNFCC. (2 010). Kuyasa Monitoring Report.

Additionally, impact surveys conducted by SSN during 2008-09 indicate that the project has had a marked impact on the socioeconomic well-being of the target community. These benefits have included:

Local Job Creation: This project contributes to local and regional employment for the community. The local residents were trained to become plumbers, electricians and builders, and they learned to install and maintain renewable and EE technologies. The project created a total of 87 job opportunities locally at Kuyasa and offered entrepreneurial opportunities for the trained residents at a regional level. Results reveal that almost half of Kuyasa residents that were trained now have fulltime jobs and/or business opportunities outside the community.

Increase in household income: All residents reported cost savings and a consecutive increase in their household income due to reduction in energy consumption and use of paraffin for heating purposes. Residents reported an average saving of US$21 (R150) per month per household during winter due to reduced paraffin usage for heating and electricity savings of US$7 (R50) per month per household.

Improved thermal comfort: The impact of insulation in a small 30 m^2 room has proven to be dramatic. The body heat of the occupants, together with cooking activity and the use of SWH inside the house for washing and cleaning, is sufficient to result in dramatically improved levels of thermal comfort. The thermal comfort level for these houses was defined as being 21ºC (69.8ºF), which was determined through research and statistical analysis to be middle of the range of winter thermal comfort levels. The monitored data from the ten pilot homes showed that on average the houses maintained average temperatures of 21.3ºC for the months of July-August, which are the coldest months, with minimum outdoor temperatures that can range between 7-10ºC (44.6-50ºF).

Indoor environmental quality and health benefits: Prior to the thermal retrofits, the majority of the households had problems with indoor condensation collecting on the roof sheeting and dripping back into the homes or running down the walls. This was a nightly phenomenon during winter, with the damp and cold atmosphere creating a favorable breeding ground for disease-causing organisms, including Tuberculosis, common in the area. Prior to the retrofits, the residents were also using paraffin heaters to keep warm in these houses, with most residents burning up to one liter of paraffin per day in winter. The use of paraffin heaters exacerbated the condensation problems, posed a fire hazard, and created unhealthy indoor air quality in these homes. The project enhanced indoor comfort levels and a consecutive reduction in the burning of paraffin for heating purposes. Most residents report having completely eliminated the use of open paraffin heaters. Apart from cost savings associated with the dramatic reduction in paraffin use, 76 percent of residents reported relief from respiratory illness resulting from paraffin fumes and improved safety conditions due to elimination of open flame heaters.

Community building: The project played a significant role in community building. Community engagement was a critical aspect throughout the planning and implementation stages, with regular meetings, periodic community updates, and a steering committee. The residents got to know one another and, as the project progressed, developed an increased sense of ownership and responsibility towards the community. As additional project benefits accrued, from reduced household energy expenditures to improved incomes and training to better health, residents became strong stakeholders and project proponents, which enhanced the overall governance within the Kuyasa community.

Figure 3: Kuyasa Social Impact Results: Resident Quotes

"The project brought skills and jobs for young men, they don't hang around street corners anymore-it has brought dignity to the community."

"I never thought a poor person like me could have a geyser. The project has given the people of Kuyasa dignity."

"The project makes us proud."

"I get a lot of visitors now, no one can laugh at my house."

"We are warm now. We are saving. We don't get flu as often. Life is much easier."

Source: Kuyasa CDM Project Website (http://www.kuyasacdm.co.za/impact.php).

The successful implementation of the Kuyasa EE retrofit project has encouraged Cape Town and all project participants to work on replicating this project on a larger scale and in other parts of the city.

4. Project Innovation

The Kuyasa project offers an excellent example to cities trying to grapple with overcoming multiple complex problems, that are often conflicting in nature—poverty alleviation, urbanization, economic growth, energy access and supply, and environmental sustainability. The project successfully demonstrates how sustainable energy interventions can be appropriate and effective in meeting the energy service needs of low-income communities. The project also demonstrates how an international mechanism such as CDM can be leveraged for poverty alleviation and sustainable development. Rather than providing these households in Kuyasa energy access through traditional supply mechanisms; Cape Town leap-frogged to cleaner technologies through the CDM mechanism, thus linking climate change to poverty alleviation.

This project is a unique demonstration of a CDM methodology being interpreted in a unique manner, one which accounts for suppressed demand for energy services. Normally, for CDM projects, UNFCCC allows for the crediting of GHG reductions against pre-project baseline energy consumption levels. However, this project could potentially result in increased energy use and consumption by Kuyasa residents as a result of the provision of improved electric wiring and increased electrical outlets in their homes. Thus, the traditional interpretation of UNFCCC's GHG gas crediting method would not be favorable for this particular project. However, the "suppressed demand" methodology for the crediting of GHG reductions was done against a baseline that is equivalent to a projected level of energy service (a warm house, sufficient warm water and light) rather than the current level of energy poverty. The uniqueness of this project not only made it the first CDM project for South Africa, it was also the first Gold Standard CDM project to be registered in the world. The Gold Standard identifies this project as a premium CDM project in terms of its design and contribution to sustainable development and showcases it internationally as an example of best practice CDM and sustainable energy project.

5. Lessons Learned

This project demonstrates the viability of government-backed EE initiatives in low income communities that have a long-term vision of not only increasing access to energy for the underprivileged, but doing so using clean and efficient technologies. The project partners for this project had a vision regarding what they wanted to accomplish in this community, but were faced with many challenges that could have hindered the execution of this project. Only long-term commitment from all stakeholders towards improving the housing conditions for the low-income communities, removing energy market barriers and sustainability, kept the momentum going and led to successful funding mobilization and implementation of the project. Designing this project as a CDM project from the beginning helped in systematic planning and execution. For example, monitoring and evaluation of the proposed technologies through a pilot project with ten households gave all project stakeholders evidence of the potential benefits resulting from the project and helped Cape Town develop the required data for CDM registration.

The project was only successful because the project partners were able to mobilize adequate financial grants to support the project. In the future, for similar projects, the City would like to retain the design and implementation strategies applied in Kuyasa, but develop alternative financing mechanisms to demonstrate the long-term fiscal sustainability of energy initiatives for the low-income communities. Engaging local residents also played a critical role in the project's success. The residents were mobilized to support the project at an early stage, invited to actively participate in executing the project, and tasked to operate and maintain the technologies in their homes. By ensuring that the local residents were trained to install and maintain the energy technologies in Kuyasa, the City was able to leverage this project to impart sophisticated technical skills to the community members and expand project benefits to include job creation and income generation. It will ensure that a similar approach is adopted in the future, and similar projects are initiated with complete buy-in and commitment with the local residents and are designed with an overall mission of improving the standard of living for community members. The project is also an example of drawing marginalized people into a global environmental issue by building human capacity around EE and renewable energy and developing social awareness about the environment and energy consumption.

6. Financial Sustainability, Transferability, and Scalability

The Kuyasa EE project has received significant international recognition and acclaim. In addition to being the first Gold Standard CDM project, the *ICLEI Association-Local governments for Sustainability* nominated the project for the World Clean Energy Awards which recognizes achievement and innovation in the integrated use of EE and renewable energy. It has also been recognized by the *Renewable Energy and Energy Efficiency Partnership (REEP)* as a model project for national replication.

The Kuyasa project holds immense opportunity for replication at a national level. There are over 1.5 million existing low-income households in South Africa which would benefit from such a program. Replication across all low-income housing in South Africa would also assist municipalities in achieving their renewable energy targets. This benefit is in addition to the many greenfield housing developments planned, for which these, and potentially other EE/ renewable energy interventions, could be used. Additionally, this project is in line with the City's SWH target of 10 percent installation (i.e., 80,000 households) by 2010 and its renewable energy generation target of 10 percent by 2020 (1.4 MWh per household per year).

However, the scalability and transferability of this project can be significantly hindered due to financial considerations. The revenue earned by this project is limited to what the community can contribute and the income from the sale of the emission reduction credits through CDM. Estimates reveal that even after considering a 21-year crediting period for this project, the CDM revenue will not be able to cover the full initial investment costs. The project was only successful as there was a significant amount of public grant finance available to close the gap between revenues and costs. These sources of funding are generally one-time grants and not considered to be sustainable or available at scale. Thus, even though this project was successful in terms of its energy, environmental and socioeconomic impacts for the community, the negative financial return on investment of this project poses a risk towards its transferability. As a result, the development of alternative financial models to enable replication of such projects in other areas of South Africa is needed.

In response to the challenge of accessing sustainable funding to enable the replication of projects similar to the Kuyasa Project, a request was made to REEEP and SSN to develop a model which can be used to access financing by similar project implementers in the future. In its analysis, REEEP/SSN points out while low-cost housing energy upgrades may have low or negative financial returns, they have numerous other benefits which can be linked to financial streams. Some of REEEP/SSN's recommendations for a sustainable financing model for EE projects in low-income communities include:

- Similar projects that use renewable energy through the SWHs (or other technologies) that may enable them to secure revenues through the use of Tradable Renewable Energy Certificates (TRECs), which would cover the price differential between coal-powered electricity provided by the state utility (Eskom) and the cost of new renewable energy generation, and be a viable course of income.
- Similarly, the savings in peak energy demand may enable a financing stream through the Integrated Demand Management (IDM) unit housed within Eskom. Eskom was not engaged during the planning or implementation of this project, yet a new demand-side management (DSM) program from Eskom is directly financing viable DSM

projects, ensuring improved EE and load shifting across the country. The revised Energy Efficiency DSM Policy, approved by the National Energy Regulator in May 2004, mandates that Eskom's DSM program fully fund viable load management projects and contribute 50 percent towards viable EE projects. This new policy can improve the financial calculation for any business, municipality or major consumer of electricity. Future projects could thus partner with Eskom during early project planning stages to tap into any available funding streams under its DSM programs. Local distribution utilities may also be interested in offering financial incentives as Kuyasa and similar projects represent considerable savings for them in terms of postponing or all-together eliminating the need to increase their supply capacity while reducing energy poverty within these low-income communities.

- Another solution being explored includes the use of an 'availability charge' on pre-paid electricity meters in use in RDP households. Pre-paid electricity meters were installed by Eskom in low-income houses that were connected to the electricity grid during the past 15 years. A pilot is currently being developed with Eskom where the Kuyasa residents would make additional contributions of US$1.0 (R7) per week via the meter before they can access 1kW of electricity. This contribution would then be redirected to cover the project costs. Similar repayment schemes can be designed with the utility for similar projects in the future.
- A similar proposal includes a suggestion to monetize the basic energy grant of 50kWh per month provided by the government to all low-income households, including the 2,309 in Kuyasa. The proposal is for the value of this grant to be transferred, on behalf of the participating household, to the project in lieu of payment. Currently this grant, valued around US$2.8 (R20) is enough to provide basic lighting, water heating using a kettle, ironing and access to a small black and white TV and radio. Such proposals are still being considered and, if approved, could help unlock the financing needed for large-scale roll-out.
- Because Kuyasa and other similar projects would result in multiple developmental benefits, access to soft loans from development banks and smaller development finance institutions to reduce the overall financing costs may also be feasible.
- The health benefits demonstrated by the Kuyasa project could be quantified and may contribute towards financing provided through the Department of Health or the Department of Housing.

In conclusion, the successful implementation of this project, along with the constraints for scalability, highlights the barriers to renewable energy and EE project implementation—particularly for low-income communities. It also highlights the need for effective policy initiatives in favor of providing adequate and clean energy access to low-income communities, supported by appropriate financial and institutional mechanisms. Some of the financial solutions identified above offer possible ways to close the financing gap and leverage the demonstrated success of this project to similar projects in the future. The City of Cape Town and all project partners are committed to replicating this project model in other large-scale efforts, which uniquely combines low-income housing improvements with employment creation, community mobilization, sustainable energy, poverty alleviation, and improved health.

References:

1. *City of Cape Town. (2011). Population profiles. Available from* *http://www.capetown.gov.za/en/stats/CityReports/Pages/PopulationProfiles.aspx*
2. *City of Cape Town. (2011). Economic Statistics. Available from* *http://www.capetown.gov.za/en/ehd/Pages/EconomicStatistics.aspx*
3. *City of Cape Town. (2008). Demographic and Socio-economic Trends for Cape Town: 1996-2007. Prepared by Karen Small. Strategic Development Information and GIS Department.*
4. *Kuyasa CDM Project Website. http://www.kuyasacdm.co.za/index.php*
5. *United Nations Development Program (UNDP). (2010). Growing Inclusive Markets. Case Study: Kuyasa CDM Project- Renewable Energy Efficiency Technology for the Poor. Prepared By- Michael Goldman. Available from* *http://www.growinginclusivemarkets.org/media/cases/SouthAfrica_Kuyasa_2010.pdf*
6. *City of Cape Town. (2008). Five Year Integrated Housing Plan 2007/8 – 2011/12.Cape Town. South Africa.*
7. *AGAMA Energy. (2003). City of Cape Town Low Cost Urban Housing Upgrade Kuyasa, Khayelitsha Thermal Modeling: Final Report. Prepared by Glynn Morris and Greg Austin, Constantia. South Africa.*
8. *AGAMA Energy. (2004). City of Cape Town Low Cost Urban Housing Upgrade Kuyasa, Khayelitsha. Solar Water Heating Model. Prepared by Greg Austin, Constantia. South Africa.*
9. *United Nations Framework Convention on Climate Change (UNFCC). (2005). Clean Development Mechanism. Simplified Project Design Document for Small Scale Project Activities (SSC-PDD). Version 14a (28th February, 2005). Available from* *http://cdm.unfccc.int/Reference/Documents/SSC_PDD/English/SCCPDD_en.doc*
10. *United Nations Framework Convention on Climate Change (UNFCC). (2010). Monitoring Report. Kuyasa low-cost urban housing energy upgrade project, Khayelitsha, Cape Town; South Africa. Version 01.1. Available from* *http://cdm.unfccc.int/filestorage/9/Q/Z/9QZH7G1C4W6TRJBEF3I8LA05UYVX2P/Kuyasa%20MR.pdf?t=RTV8bHZ1bGlmfDBHob20TQ9j5rOD3a5uyr4t*
11. *GREENXENERGY. (2007). FAQ's about Tradable Renewable Energy Certificates (TREC's). Available from http://www.steadfastgreening.co.za/docs/FAQs_about_TRECs.pdf*
12. *Energy Management News. (2004). ESKOM's DSM Program Offers Greater Financial Support to Businesses and Municipalities. Volume 10. No. 4. Available from* *http://www.erc.uct.ac.za/emnews/Emn-dec04.pdf*
13. *Renewable Energy and Energy Efficiency Partnership (REEP). (2005). The REEEP/ SSN Sustainable Financing Model Project. Background and Introductory Paper, September 200. Available from http://toolkits.reeep.org/file_upload/10307023_4.pdf*
14. *Epp Baerbel. (2009). Kuyasa-South Africa's First Clean Development Mechanism Project. Global Solar Thermal Energy Council. Available from http://www.solarthermalworld.org/node/526*

ANNEX: CITY AND PROJECT PROFILE

CITY PROFILE

1.	**Name of the City**	**Cape Town**
2.	**Area**	**2,479 square kilometers (957.15 square miles)**
3.	**Population**	**3.4 million (2010)**
4.	**Population Growth Rate**	**0.01% (2006-2010)**
5.	**GDP of the City**	**US$26.6 billion (R188.46 billion) (2009)**
6.	**GDP Growth Rate**	**4.06% (2005-2009)**
7.	**GDP per Capita**	**US$7,840 (R55,428)**

PROJECT PROFILE

1.	**Project Title**	**Kuyasa Low-Income EE Housing Project**
2.	**Sector**	**Residential Buildings**
3.	**Project Type**	**Energy Efficiency Building Retrofit**
4.	**Total Project Capital Cost**	**US$4.67 million (R33 million)**
5.	**Energy/energy cost savings**	**155 million kWh (34%)**
6.	**Internal Rate of Return**	**-12%**
7.	**Project Start Date**	**1999**
8.	**Project End Date**	**2010**
9.	**% of Project Completed**	**100%**

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