CASE STUDY

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Local Governments for Sustainability

Improving Energy Efficiency in
Ekurhuleni Metropolitan Municipal Buildings

City Profile

Ekurhuleni Population:	2.5 million
Land Area of the City:	1,900km2
Municipal Budget:	Operational: R10,2 billion ($1.68 billion USD) Capital: R1,1 billion ($0.18 billion USD)

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Abstract

This case study highlights the Ekurhuleni Metropolitan Municipality's (EMM's) leadership in implementing an energy retrofit project in its municipal buildings. Based on the adoption of the Policy on Energy Efficiency in Council Buildings and on Council Premises, and the participation in ICLEI's Cities for Climate Protection® (CCP) Campaign, the EMM was able to implement different cost-saving and energy-saving measures in three municipal headquarters buildings. The project shows how small measures have significant outcomes in reducing energy use and subsequently reducing greenhouse gases (GHGs) and other air pollutant emissions. Further, it is as an interesting demonstration and test of an advanced lighting technology and energy efficiency equipment. An inter-departmental taskforce within the city government proved to be one of the keys to successful project implementation and to providing insights for its replicability in other South African municipalities.

Boksburg City Hall

EGSC Building

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Project Background

The City of Ekurhuleni has done outstanding work on institutionalising a sustainable energy approach through conservation practices in municipal buildings. The council adopted the Policy on Energy Efficiency in Council Buildings and on Council Premises of Ekurhuleni in 2002, and since 2004 Ekurhuleni has been a member of ICLEI's CCP Campaign.

The need to develop an energy efficiency policy was first identified by the Department of Municipal Infrastructure within the EMM. The main motivation for this initiative was the increasing awareness regarding global warming and the associated climate change impacts that the city will have to overcome. It became evident that EMM should use all forms of energy efficiently and, in general, use energy sparingly, and lead by example for the rest of the community.

The policy aimed to optimize the use of resources in municipal buildings and to reduce the amount of waste produced. If implemented properly, the result would be reduction in expenditures. The Directorate of Electricity of EMM wrote and developed the policy.

In 2005 the Department of Environment and Tourism developed and finalized the State of Energy Report and developed its first draft of an Energy Efficiency Strategy. This was an important complement to the policy and determined the guidelines for new projects in energy efficiency and energy conservation. One of the conclusions of the report was that, although energy consumption by the Council was not so significant, there was an opportunity for EMM to start saving energy with "low hanging fruits."

At the national level, the South African government has developed and approved the Energy Efficiency Strategy. Some of the reasons for the development of this strategy are because energy efficiency has significantly gained in stature and has become recognized as one of the most cost effective ways of meeting the demands of sustainable development. The benefits of energy efficiency for the environment are self-evident. These benefits are of particular relevance as South Africa remains one of the highest emitters of the greenhouse gas CO_2 per capita in the world. At a local level the problems of SO_2 and smoke emissions have been the focus of concern for many communities living adjacent to heavily-industrialized areas.

As a result of the momentum gained, both at the national and local level, the City of Ekurhuleni started to implement the retrofitting project. The Germiston Civic Centre and the EGSC buildings were then identified by the Department of Environment and Tourism to be the initial target for implementing the city's Policy on Energy Efficiency. These buildings serve as the EMM political head office and the administration head office, respectively.

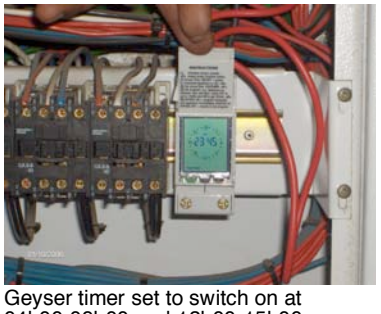
Project Description

The project of improving energy efficiency in EMM buildings started in June 2005 with the call on all suitably-qualified entities to submit quotations to carry out all the necessary work to achieve the set objective of saving energy and reducing GHG emissions. The leading department was Environment and Tourism but other departments were involved, including the Municipal Infrastructure department (Electricity directorate) and Roads and the Transport and Civil Works department (Building Maintenance section).

The first proposal included the supply, delivery, and installation of solar water heaters; compressors; and 10 KW solar photovoltaic panels. A preliminary analysis of the building's infrastructure, design, and plumbing systems determined that the installation of solar energy would add more complexity and time to the work. The retrofitting project was to be completed before the end of the municipal financial year: June 30, 2005.

The second proposal was the use of different mechanisms to reduce energy consumption in lighting and boiling water. The mechanisms included the replacement of conventional incandescent lights with compact fluorescent lightbulbs (CFLs), the replacement of cool-beam down lighters with light-emitting diodes (LED) lights, the replacement of urns and kettles with hydroboils, and the installation of geyser and lighting timers. These measures were determined to be more cost effective and could be implemented within the set timeframes and allow significant reductions.

The CFLs are very efficient and inexpensive with high return on savings after the initial investment. They have been designed to screw into standard sockets, which allow them to be used very easily instead of incandescent light. LEDs are small,



Geyser timer set to switch on at 04h00-09h00 and 12h00-15h00

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solid lightbulbs, which are extremely energy efficient. The Zip hydroboil is a wall-mounted, instant-boiling water heater, which means that boiling water is available instantly. It cuts down on water bills, as there is no evaporation due to escaping steam. It also saves electricity/energy because it consumes less compared to urns (see Table 2) and all the water that is boiled is used. Geyser timers regulate when the water can be heated by connecting electricity to the geyser at specified times. This saves energy because water is not heated throughout the day.

Summary of Equipment

- Twenty-three (23) zip hydroboils
- Two-thousand-and-three (2,003) CFLs
- Ninety (90) LED lights,
- Two (2) lighting timers,
- Fifteen (15) Geyser timers, and the
- Replacement of ninety-six (96), 8-foot double fluorescent light fittings with open channel-5 foot double fluorescent lights with electronic ballasts.

Costs and Implementation

El Shaddai Electrical and Ganibo Trading, both from Ekurhuleni, were the companies awarded the contract for the retrofitting project and they purchased and installed the equipment. The work started in December 2005. The total cost of the project, including labor and equipment, was R249,120 ($41,063). ICLEI secured a grant totalling R242,761 (USD $40,000) from the United States Agency for International Development (USAID) to fund this project. The unit price of equipment as quoted by the service providers (El Shaddai and Ganibo companies) is as follows:

Geyser timer set to switch on at 04h00-09h00 and 12h00-15h00


Geyser timer set to switch on at 04h00-09h00 and 12h00-15h00


Lights timer set to switch on at 05h30 and switch off at 19h00


8 foot double fluorescent lights

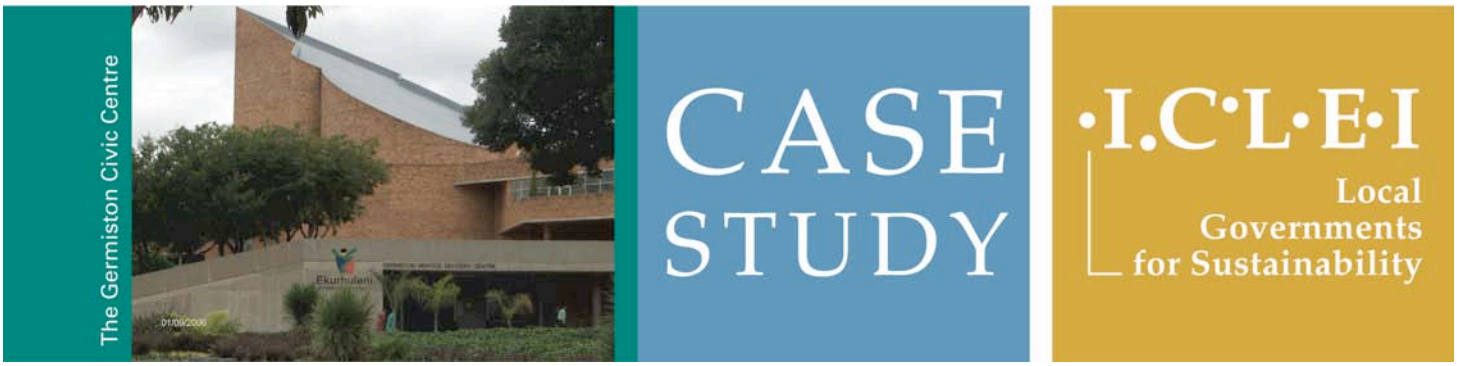

Table 1. Equipment Costs per Unit

Equipment	Cost in South Africa Rand (ZAR)	Cost in USD*
Hydroboils	R 4,775.00	$ 786.64
75 W (low wattage) CFLs	R 15.00	$2.47
LED lamps	R 15.00	$2.47
Lights timer	R 450.00	$74.21
Geyser timer	R 450.00	$74.21
5-foot double fluorescent light	R 104.50	$17.23

* The exchange rate used is for 02/02/2006: 1 USD = 6.06375 ZAR

Results

The energy savings that resulted from the implementation of the retrofitting project in the EMM's buildings are:

Table 2. Results on Energy Savings

Equipment	Pre retrofit Energy use kWh/year	Post retrofit Energy Use kWh/year	Energy Savings kWh/year	Percentage of Savings %
Lighting (CFLs and LEDs)	366,694	91,673	275,020	75
Lighting (5 foot double fluorescent lights with electronic ballasts)	21,024	18,221	2,803	13
Water Heating (Urns replaced with Zip Hydroboil)	214,072	171,258	42,814	20
Gyser timers	20,878	12,527	8,351	40
TOTAL	**622,668**	**293,679**	**328,988**	**53**

Notes: Energy consumption values reported by EMM.

The results in terms of emissions reductions for both greenhouse gases represented in CO_2 equivalent and other air pollutants—particularly NO_X, SO_X, and total suspended particulates (TSPs)—are:

Table 3. Results in Emissions Reductions

Equipment	CO2e Reduction Tonnes/year	SOx Reduction Kgr/year	NOx Reduction Kgr/year	TSP Reduction Kgr/year
Lighting (CFLs and LEDs)	257	2,183	1,025	84
Lighting (5 foot double fluorescent lights with electronic ballasts)	3	22	10	1
Water Heating (Urns replaced with Zip Hydroboil))	40	340	160	13
Gyser timers	8	66	31	3
TOTAL	**308**	**2,611**	**1,226**	**100**

Notes: Data obtained from ICLEI HEAT, which contains South Africa specific emission factors (www.icleiheat.org)

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Results *(continued...)*

A small scale retrofit project, such as the EMM's buildings project, results in 328,988 kWh of energy saved in one year, this represents economic savings in the order of $ 50,664 USD per year (using the value of 0.157 USD/kWh for Ekurhuleni Municipal Buildings under tariff C given by EMM). A simple payback period, taking into account the total investment, will be 1.2 years. This is a very significant output considering the co-benefits in GHG emissions reduction: 308 tonnes of CO_2e, 3 tonnes of SO_X, and 1 tonnes of NO_X reduced.

Acceptance of Technology

Since the installation of the new lights and water boilers, there have been no equipment problems reported by the staff or any complaints about the quality of lighting or water. Everyone seems happy with the project.

Lessons Learned

A retrofitting project involving the replacement of old equipment with new, more efficient technology is a quick way to start saving energy and money. The project itself does not require a long time to implement. However, in municipally-owned buildings and municipal operations, the council procedures and policies need to be followed and this may add time to the process. Further, there are challenges to getting different departments within the government to work together, from the planning stages to actual project implementation. The experience gained by Ekurhuleni through this project will help other cities benefit from, and replicate, their own integrated energy efficiency projects.

It is also important to select the right people and companies to do the work. Since the energy efficiency technology and equipment is relatively new in the South African market, it is not easy to find experienced tradesmen to provide the necessary services. This will improve as the demand from more local governments and institutions for energy efficient equipment increases.

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Key Replication Aspects

The creation of the policy on Energy Efficiency in Council Buildings and on Council Premises, the State of Energy Report, draft Energy Efficiency Strategy of Ekurhuleni, and the subsequently implemented retrofitting project are all part of an easily-replicable strategy that can be used in other South African cities interested in reducing energy costs and minimizing the negative environmental impacts of their municipal operations.

The equipment bought and implemented in the municipal buildings in Ekurhuleni government—energy-efficient lighting (CFL, LED), timers, and efficient water boilers—have all proven to be cost effective and will become more available in South Africa.

In order to complete a successful project, other cities should allocate enough time for the project during the planning phase and assemble a motivated team comprised of all relevant departments in order to achieve efficient project implementation.

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