CASE STUDY

BUFFALO CITY METROPOLITAN MUNICIPALITY

ENERGY EFFICIENCY AND RENEWABLE ENERGY IN MUNICIPAL BUILDINGS

PROJECT OVERVIEW

In response to the national power shortage and to encourage the uptake of sustainable energy, the Eastern Cape Provincial Government's Energy Efficient Policy encouraged municipalities to source at least five per cent of all energy from renewable sources and roll out energy efficiency programs.

Buffalo City Metropolitan Municipality (BCMM) implemented a pilot project to convert a municipal building into an energy efficient one and raise public awareness on the topics of energy efficiency and renewable energy.

The municipal building in Beacon Bay (see cover picture), which houses the Electrical and Finance departments, was selected as the site for the pilot project.

The project was implemented over a period of 17 months from October 2014 to March 2016. This included technical discussions, support, financial input, and cooperation with the metros' international partner, the City of Oldenburg in Germany. Once the scope had been defined and a contractor secured, the installation phase took 6 months, from October 2015 to March 2016.

The aim of the pilot project was to achieve a saving of 20 per cent of electricity used in the building by implementing energy efficient initiatives which included:

- The installation of a solar water heater
- LED lighting
- Hybrid air conditioning unit
- Occupancy sensors on all lighting

The project also aimed to install renewable energy generation technologies (wind and solar photovoltaic) on the building and pilot different grid connections and metering structures.

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BUFFALO CITY METROPOLITAN MUNICIPALITY

TECHNICAL DESCRIPTION

Phase 1: Energy Monitoring

To establish a baseline of electricity usage in the building the first step was the installation of a four quadrant smart meter to map and record electricity consumption in the building. The baseline study showed an average consumption of 6427 kWh per month between March and September 2014.

Phase 2: Energy Efficiency installation

The next phase was to implement a comprehensive **energy efficiency installation program**. This phase involved the following:

- Replacement of all incandescent light bulbs with energy efficient LED lights that have a payback period of only 18 months. The electrical power of the tubes was decreased by 65% and went from 58 watts to 20 watts. The life span is 25,000 hours burn time what comes to an approximate life span of the LED tubes of eleven years. All the LED lights carry a two year warranty, with the exception of LED flood lights, carrying a five year warranty.
- Installation of occupancy sensors to all lighting circuits to avoid unnecessary use of electricity in unoccupied rooms.
- Installation of a 150 l solar water heater to replace two of the existing electrical geysers. The replacement of the geysers reduced the load of the building by 4,000W (2,000W per geyser).
- Replacement of standard ceiling fans in the foyer (public entrance) and payments hall with a hybrid air conditioner. The hybrid air conditioner provides air conditioning to the area and pre-heats water before it enters the remaining electrical geyser that services a different area of the building. The pre-heating of the water reduces the power required to heat the water in the geyser.

Phase 3: Renewable Energy Installation

Once the energy efficiency program was completed, the **renewable energy programme** started with the following installations that are adding up to a total of 22.1 kW:

- Three different types of Photovoltaic (PV) panels were installed on the roof of the municipal buildings to generate electricity and for educational and demonstration purposes:
  - A 20kW grid tied system made up of 84x250 watt polycrystalline PV panels with back-up batteries was installed to reduce the power consumed in the building, but also for demonstration of the use of PV in the commercial sector.
  - A small 1,500W home style system made up of 6x250W PV panels with back-up batteries was installed as a demonstration for use in the domestic sector.
  - A small off-grid 100W system was also installed for demonstration purposes and as an alternative solution for households who cannot be connected to the grid. The metro has large informal areas that do not have access to legal electricity, and in these areas, several members of these communities connect illegally to the electricity grid, which are extremely unsafe. The system provides power for four LED lights, a small television, and has charging ports for mobile telephones.
- A 600W micro wind turbine was installed as a back-up to the installed PV panels and for demonstration purposes. It carries a five year warranty.

Phase 4: Community Awareness

The final phase of the project was to showcase the project to municipal staff as well as the public. To achieve this goal, a visible monitoring system has been installed at the entrance of the municipal building, which showcases the outcome of the project and the principles of energy efficient buildings. This visual showcasing of the project raises public and municipal employee awareness of its benefits. It even features an “energy saving competition” between the Engineering and Administration teams of the Electricity Department. In addition, training has been provided to the municipal staff in the use of sustainable energy technologies.

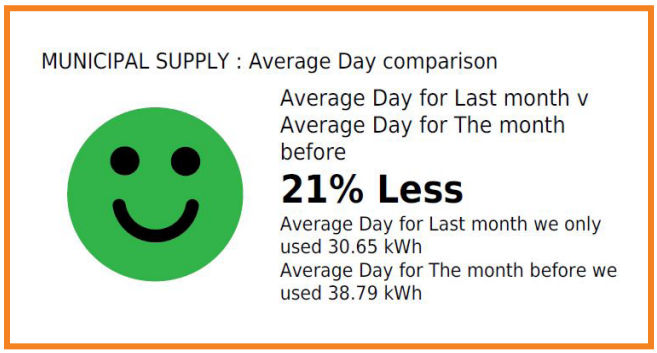
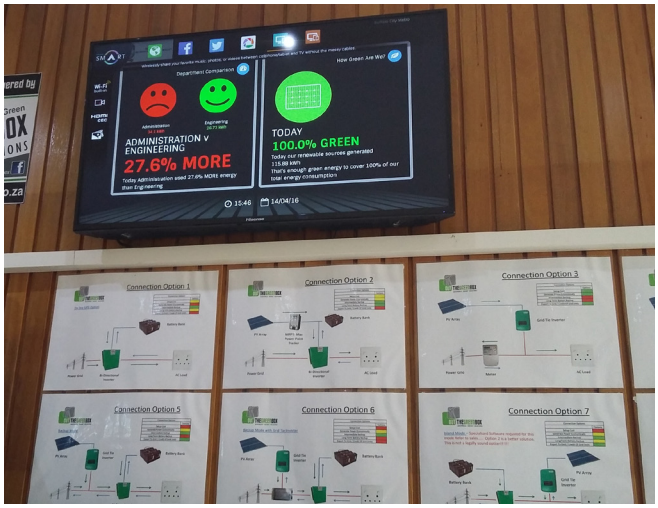


Figure: Example of what is displayed on the television screen in the entrance to the building

Pamphlets (*included in this brochure*), some of which are child friendly have also been developed to provide information about energy efficiency, as children are often the drivers of change in households.

PROJECT BUSINESS MODEL

The project costs total R1.4 Million. Half of the project was financed by BCMM and the other half was financial support from German development partners. The German contribution has mainly been provided from the “fund for municipal partnership projects” from the German Ministry for Economic Cooperation and Development; smaller amounts have been contributed by the State of Lower Saxony and the City of Oldenburg.



Energy Management System at the electricity offices in Buffalo City Municipality

Procurement

The installations have been procured through a formal tender process, following the principles described in the Municipal Finance Management Act (MFMA), based on the technical specifications defined by the municipality in cooperation with its German partners. The tender was won by the East London based company “Out the Green Box”. One of the goals of the project was to achieve at least 50 per cent purchases from local manufactures of the components installed. The project achieved 70 per cent procurement from manufacturers within the Eastern Cape, with the photovoltaic (PV) panels, Hybrid air conditioner, and batteries purchased from East London based companies and most of the inverters purchased from a company based in Port Elizabeth. To add on the local content, all the LED lights were purchased from companies based in Cape Town and the solar geyser was purchased from a Johannesburg based company. The 20kW grid tied inverter was imported from Germany.

EQUIPMENT	MANUFACTURER	LOCAL	WARRANT
20kW Grid Tied Inverter	ABB	No	5 Year
100 watt PV Panel	Enersol	No	25 Year
250 watt PV Panel	ILB Helios	Yes	25 Year
1kW & 10kW Bi-directional Inverter	Microcare	Yes	3 Year
40amp & 100amp MPPT	Microcare	Yes	3 Year
1.5kW Grid Tied Inverter	Microcare	Yes	5 Year
Automatic Changeover Box	Out The Green Box	Yes	1 Year
100w small Home Unit	Out the Green Box	No	1 Year

Table: Main components used in project

Energy management system and diverse PV connection options and inverters

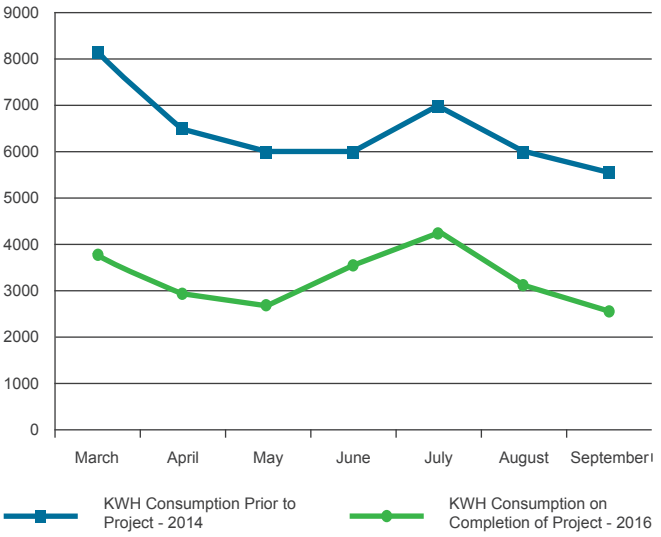
Maintenance

The specification also allowed for operation and maintenance for a three year period. This required the contractor to provide a monthly report as well as a monthly inspection of the installations and to complete any required repairs. All equipment carries a 12 month warranty/liability in case of equipment failure.

ELECTRICITY SAVINGS

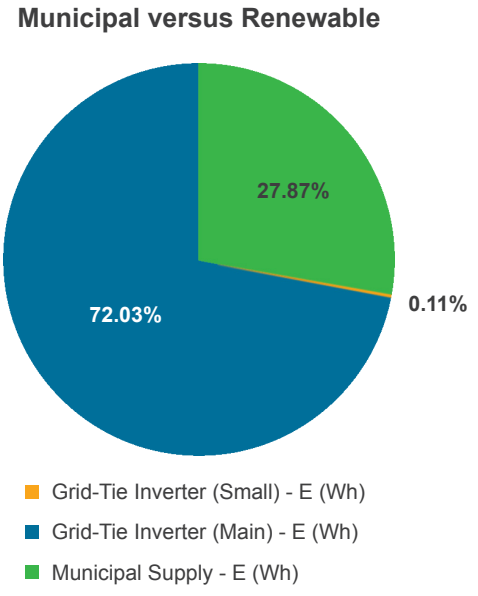
The graph below shows that the electricity demand of the building has decreased on average by 50 per cent since the energy efficiency measures started and the installation of the renewable energy systems had been completed.

The maximum demand (kVA) has also been drastically reduced. Prior to this project the building was using in excess of 50kVA. Nonetheless, installation of a PV system cannot guarantee a reduction in maximum the maximum demand, due to the fluctuation in solar radiation.



Graph 1: Month by Month KWH Consumption per year

Graph 2 shows that, due to the decreased consumption levels and the building's own generation of electricity, only 28% of the building's electricity requirements in September 2016 was drawn from the municipal grid whereas 72% was supplied internally.



Graph 2: Total KWH Consumption for March to September 2014 and 2016

PROJECT TIMELINE

October 2012

Initiation of the partnership between Buffalo City Metro and City of Oldenburg for the project.

October 2014 - March 2016

Project implementation

1 February 2014

Smart meters installed

1 July 2015

Baseline for Energy Consumption developed

Tender for installations published

Budget for project available

5 October 2015

Service provider selected

7 October 2015

Start of implementation of installations

21 October 2015

Inauguration ceremony for the project at Beacon Bay Electricity Office. Major part of the installations implemented.

31 March 2016

Installations were finalised and monitoring systems put in place. The implementation of the project concluded.

Key Project Data

Start of Operations

2016

Location

The Electrical and Finance departments in Beacon Bay, BCMM

Average electrical savings

50%

Capacity of renewable energy installations

22.1 kW

Technology

Energy efficiency measures (LED lights, occupancy sensors, solar water heater, hybrid air-condition) and small scale renewable energy installations (PV rooftop, wind turbine)

Key Actors

Owner

Buffalo City Municipality

Service Provider

Out the Green Box
NEXT Energy (Oldenburg, Germany)
Municipality of Oldenburg

Financers

Buffalo City Municipality, German partners: German Federal Ministry for Economic Cooperation and Development, State of Lowes Saxony and the City of Oldenburg.

Business Model

Project Delivery Model

Municipal project, with O&M contract outsourced to a service provider

Electricity Production

Electricity is fed into the municipal grid

Cost

Capital cost

R1.4 million

Operational costs

Not yet available

CHALLENGES, ENABLERS AND LESSONS LEARNT

Permit and licensing processes

At the time of the project preparation, a draft rule from the energy regulator NERSA was planning to exempt installations of less than 100kvA from the need to obtain a generation license. On this basis, the municipality went ahead with the installations without requesting a distribution license. The electricity generated is consumed by the municipality and not sold onwards.

Finance

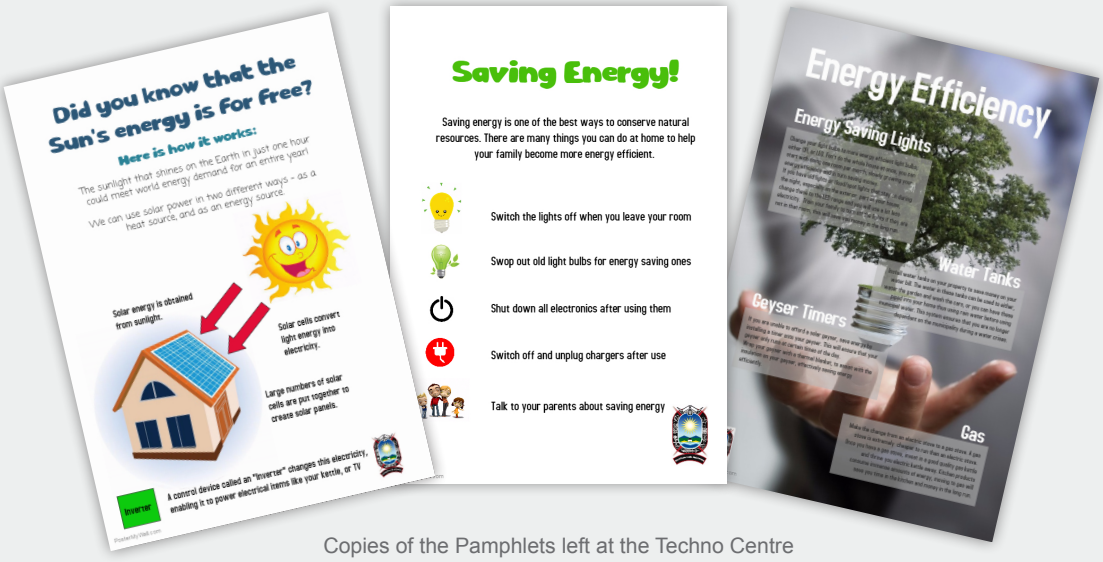
The project funds from BCMM have been provided by the Electricity Department's annual budget for the 2015/2016 financial year. It is a goal of the municipality to improve its own energy efficiency and the use of renewable energy as well as to educate its citizens about the advantages of sustainable energy. The payback period for the installations is only 18 to 24 months.

Lessons learnt

The experience of the municipality with this pilot project has been very positive. Different technologies are being showcased to the citizens of the municipality and reliable data for energy savings is provided by the energy monitoring system at the entrance. It gives concrete evidence to citizens as well as to municipal officials of the cost savings can be achieved through the use of renewable energy technologies and improving energy efficiency in buildings.

WAY FORWARD

Due to the positive results of the project, BCMM is in the process of formulating a tender to investigate the potential of energy efficiency savings within all municipal buildings. The tender will also establish the potential of waste-to-energy, wind and hydro energy within the municipal boundaries. The success has inspired the BCMM to chart a way forward in reducing the municipality's carbon footprint.



Copies of the Pamphlets left at the Techno Centre

Published by:	The South African Local Government Association (SALGA) in partnership with SAGENnand the Buffalo City Metropolitan Municipality. SAGEN is the South African German Energy Programme implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).	
Authors:	Nicolas von Kalm (GIZ)	
Acknowledgement:	The authors would like to thank the municipal officials in particular Rob Ferrier and Jan Smit, and representatives of the project developers / implementers who provided a lot of information and without whom the publication of these case study would not have been possible.	
Sources:	Buffalo City Metropolitan Municipality: Rob Ferrier and Jan Smit	
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