



# **KHANYISA PROJECTS CASE STUDY**

NDWEDWE RURAL BIOGAS PROJECT

## **AT A GLANCE**

### **FUNDERS**

South African National Energy  
Development Institute (SANEDI)

### **TIMELINE**

2013 to 2014

### **AREAS**

Ndwedwe Municipality, KwaZulu Natal

## **KEY STEPS**

- Planning, design and model selection
  - (6m3 brick and mortar)
- Stakeholder engagement
- Builder selection and training
  - (7 local builders were trained)
- Selection of beneficiary households
  - (26 were selected)
- Construction of brick and mortar model with fibreglass dome
- Priming and testing
- Detailed assessment

## **OBJECTIVES**

**Why:** Many thousands of rural households have limited access to safe energy for cooking, lighting, heating water and other needs.

**What:** Biogas was identified as a sustainable fuel available to rural households with livestock waste.

**How:** The assessment investigated environmental, cost and sustainable benefits of the project.

## **KEY BENEFITS**

- The need for other fuels such as wood, paraffin, LP gas and electricity can be substantially reduced.
- Health and safety for rural households is improved through the reduced use of flammable and smoke producing fuels such as paraffin and wood.



## FULL OVERVIEW

Many thousands of homesteads in rural kwazulu natal have limited access to safe energy for cooking, lighting, heating water and other needs. In addition, rural households often don't have access to safe hygienic sanitation systems. In many areas women walk long distances to collect firewood or spend a high proportion of their monthly income on fuels such as paraffin.

A biogas digester, through the production of methane gas can provide for cooking and water heating needs while at the same time producing effluent fertiliser rich in nutrients. The effluent can be used to significantly increase the agricultural yields in food gardens. The biogas digester can also provide a safe hygienic sanitation system for rural households.

Other key benefits include:

- the need for other fuels such as wood, paraffin, LP gas and electricity can be substantially reduced
- health and safety for rural households is improved through the reduced use of flammable and smoke producing fuels such as paraffin and wood

Digesters require organic waste to be able to operate. A key factor in rural areas is that many households own livestock. The manure from this livestock can be used to increase the amount of biogas produced.

A barrier to the development of biogas as an energy solution in rural areas is the lack of local technical skills for construction as well as support to users. This means these skills have to be brought in from urban areas at great expense. A second objective of this project is therefore to generate local technical and building skills through a practical training programme linked to the construction of the biogas digesters.

It was felt that the local municipality of ndwedwe under ilembe district municipality was an area which was typical of a rural kwazulu natal community.

On the basis of these needs and the status quo in ndwedwe, a proposal was submitted to the south african national energy development initiative (SANEDI) who manages the working for energy programme (WFE) on behalf of the department of energy. The WFE aims to provide alternative forms of energy to cater for the needs of poor communities while at the same time linking to the expanded public works programme (EPWP). The proposal aimed to train a number of local builders to construct 26 six cubic meter digesters with greywater and gas fittings.

## STAKEHOLDER ENGAGEMENT

No project of this nature can be successfully rolled out without a comprehensive stakeholder engagement programme. The first intervention was with the acting municipal manager at the time mr mike newton who willingly approved the project in the ilembe district municipality.

The key steps that followed included:

- Workshops with the ilembe enterprise development unit
- Meetings with key LED officials from ilembe and ndwedwe municipality
- Presentations to ndwedwe council including the mayor
- Discussions with the department of agriculture in ndwedwe
- Meetings with ward councillors
- Meetings with amakhosi and development committees

The two wards selected by the council for this project, ward 14 and 18, each had a number of amakhosi areas falling within their jurisdiction. The project team were able to successfully engage with all these stakeholders. The key outcomes have been that at no stage has the project been stopped by community or political issues and the builders employed on the project have in most cases been of an acceptable quality. The selection of beneficiaries within wards by the structures also progressed without any hindrance.

## INNOVATIVE APPROACH

Biogas digesters have been built in rural areas on other projects in the province but this is the first time that a comprehensive building training programme has been embarked on to transfer biogas building skills to local contractors.

The biogas digesters built utilised a combination of brick and mortar with a fibreglass dome as well as a LDPE greywater line and composite pipe for the gasline to the kitchen. Each household was supplied with a two plate stove which was converted to operate on methane gas. The use of locally available materials for most of the construction rather than a fully pre-fabricated model allowed for the transfer of the building skills.

The 6m<sup>3</sup> digester can cater for up to 40 kilograms of organic material daily and up to 1 000 litres of water via the greywater system. In cases where the rural household had installed a flush toilet this was connected to the digester as well. The outputs of the system are up to 2m<sup>3</sup> of methane gas daily as well as nutrient rich effluent that can be used for fruit trees and food gardens.

## PROCESS STEPS

The key process steps are set out below:

- Planning and design (a sketch of the selected design is included in the Annexures)
- Stakeholder engagement
- Builder selection
- Selection of beneficiaries
- Beneficiaries were selected based on access to livestock manure, agricultural activities and greywater access.
- Construction training and mentoring included:
  - Site selection
  - Material supply (local suppliers were used where possible)
  - Technical supervision
  - Gasline and greywater line installation
  - Testing for leaks (gas and water) and priming
  - Training in gas operation and maintenance as well as agricultural use of the effluent
  - Project completion certificate
  - Mentoring and aftercare

Besides the training of beneficiaries in the operation and maintenance of the system, municipal staff were given technical support to raise their awareness on the technology.

## PROJECT OUTPUTS

The following outputs have been achieved on this project:

- 26 six cubic meter digesters at farms and homesteads
- 7 local builders were trained to construct digesters according to the design
- 1 200 work days were provided to local members of the community in the support of the builders and are recorded on the attached EPWP report
- Two local building material suppliers were utilised
- Clear evidence of an increase in awareness of biogas as a technology in the ndwedwe area and a desire by other members of the community to also utilise the technology (market penetration)

## ENVIRONMENTAL SUSTAINABILITY

A number of environmental outputs have been achieved through this project.

- Increased awareness within the municipality to understand and utilise biogas digesters as a renewable energy option to provide energy to the poor
- Reduction in carbon footprint and GHG emissions through the use of renewable sources of energy
- Closure of ecological loops within agriculture through the use of effluent as a fertiliser
- Improved quality of life through improved air quality (reduction in the use of wood and paraffin)
- Environmental impact on forest areas through reduction in the use of firewood

## FINANCE & MANAGEMENT OF THE PROJECT

The approved budget for the project was r1.6 million. However, due to a number of efficiencies achieved during the implementation including material and labour cost savings, the scope of the project was extended. The labour costs savings were mainly achieved through the use of a task based approach.

The scope of the work within the original budget was extended to include rainwater harvesting tanks to houses without a reliable source of water. Besides the humanitarian need for water for drinking, cooking and washing, water is a key component of the biogas digester process.

### Cost benefit analysis

The average cost of the biogas digester excluding the rainwater harvesting system is approximately r50 000 although this cost will decrease for new phases as builders will not need to be retrained and the stakeholder engagement requirements will also be reduced.

The estimated annual cost savings are based on the following assumption.

- 1,4m<sup>3</sup> of methane gas produced and used daily
- 1,4m<sup>3</sup> of methane gas used daily is equivalent to approximately 220kg LP gas per year
- Cost of LP gas is r24/kg
- Total annual savings will be r5 280

The payback period excluding interest will be approximately 9,5 years although this excludes the value of the effluent for agriculture.

## SUSTAINABILITY

A number of steps were taken to assist with sustainability of the project.

These included:

- Training of beneficiaries will help to ensure correct operation of the system
- Officials of both ilembe and ndwedwe have been included in the process and will thus have an understanding of the support requirements
- The department of agriculture was also included so that they are aware of the opportunities for agricultural activity
- The ilembe municipality stated that the project fits within their 2020 vision for renewable energy and that they would consider scaling up the project.

## CHALLENGES

A number of challenges were experienced on this project. The challenges experienced and the mitigating actions taken are set out below.

Challenge	Mitigating action
Two nominated builders had a poor attitude to the project and a lack of skills	In one case additional training was provided while in the other case, the builder was replaced
Large rocks were found in some areas when digging holes for digesters by hand	In one case the hole position was changed while in the other, additional mechanical equipment was hired
A lack of water for building and testing of the digester was experienced at some sites	In some cases water tankers from ilembe municipality were used while in other cases where access was poor, water was pumped from rivers up to one kilometre from the site
Additional engagement with multiple amakhosi structures was required	Additional time for this activity was set aside

## QUALITY ASSURANCE

All work was checked and tested under the supervision of Dave Alcock, a biogas specialist with over 20 years experience. No builder was paid until the completion certificate was signed off by the technical manager. Aftercare and mentoring was also provided for a three month period.

