



# F · I · E · L · D · N · O · T · E

MARCH 2013

## SANITATION FOR ALL

Four Innovative Sanitation Projects in Zambia  
*Faecal Sludge Management Aspects and General Lessons*



**GOOD AND SUSTAINABLE SANITATION IS THE BASIS FOR PERSONAL AND ECONOMIC DEVELOPMENT AND FURTHER MEANS DIGNITY FOR PEOPLE. PROFESSIONALS RESPONSIBLE FOR IMPLEMENTATION OF SANITATION PROJECTS SHOULD DEVELOP PRACTICAL AND CONVENIENT SOLUTIONS FOR USERS AND OPERATORS.**



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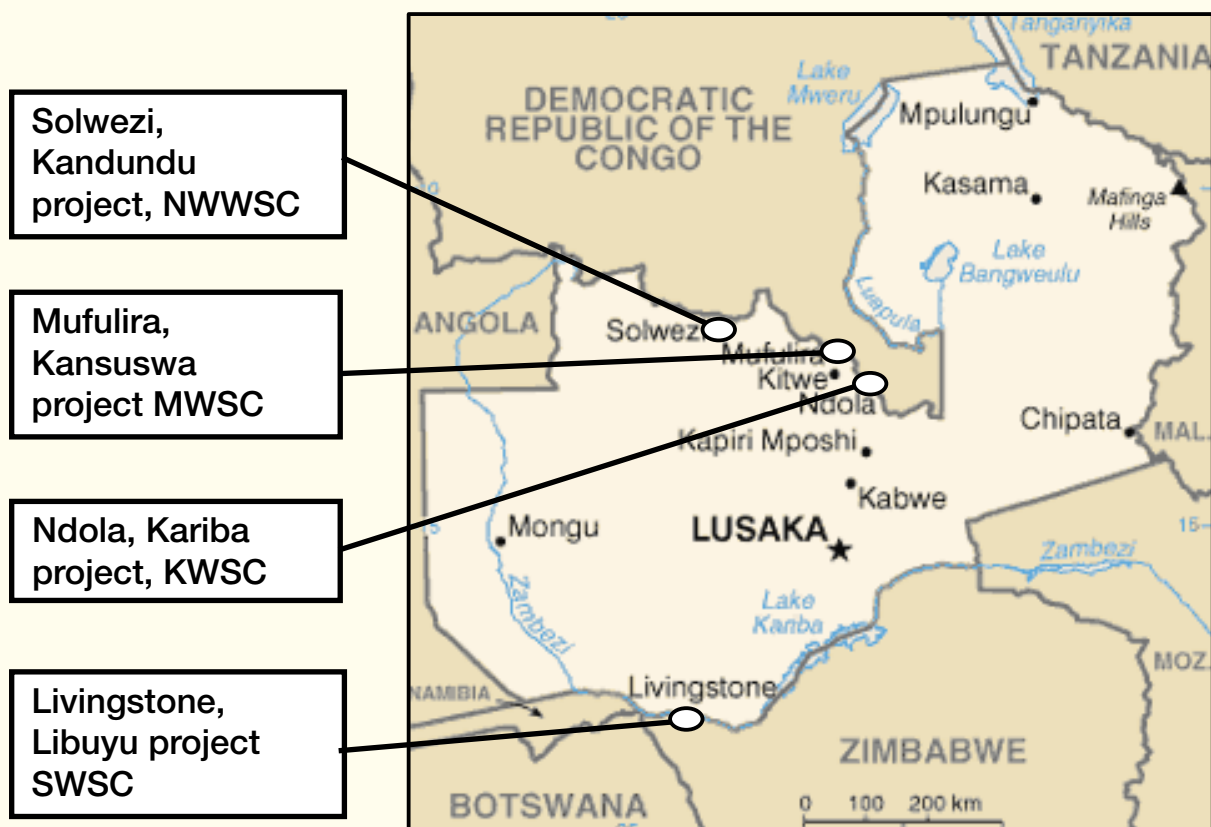
1

## *Introduction*

Although the urban sanitation coverage in Zambia was 57% in 2012 (according to the National Water and Sanitation Council - NWASCO), sanitation services in low-income areas (low-cost and peri-urban) are mostly not available. About 60% out of 5.2 million urban Zambians live in peri-urban areas. Like most unplanned areas; these are characterized by high-density population figures, heterogeneous social dynamics, unclear land tenure situation, unplanned settlement structures and almost no enforcement of laws and standards. Roughly 90% of peri-urban dwellers use inappropriate pit-latrines.

About 20% of urban dwellers live in low-cost areas. Those areas were planned and constructed in the years around the time when Zambia gained independence and they were populated by civil servants mostly. Today, these houses are rent out to the urban low income population. Over the time the infrastructure dilapidated due to insufficient repairs and maintenance.

The DTF was established by the national regulator NWASCO under the Water Supply and Sanitation (WSS) Act No 28 of 1997 as an instrument to assist Commercial Utilities (CUs) to improve Water Supply and Sanitation (WSS) services for the urban poor. The DTF was operationalized by Statutory Instruments and has been fully operational since 2003.



*Map of Zambia showing the location of the four projects.*

Since then, the DTF has been a major partner to CUs in financing and implementation of projects that have led to improved Water Supply Services for more than 850,000 people living in Zambian low income areas.

In 2008 the DTF, in partnership with the local NGO WASAZA (Water and Sanitation Association of Zambia) and the German NGO BORDA (Bremer Overseas Research and Development Association) developed a “sanitation concept and sanitation implementation approach.

In 2009, DTF started the implementation of four sanitation projects with four CUs established by Local Authorities under the Water Supply and Sanitation Act no. 28 of 1997 and duly licensed by the regulator NAWASCO.

The four utilities are:

- Kafubu Water and Sewerage Company (KWSC)
- North Western Water and Sewerage Company (NWWSC)
- Southern Water and Sewerage Company (SWSC)
- Mulonga Water and Sewerage Company (MWSC)

These projects are targeting more than 15,000 people with improved household sanitation services in low-income areas. Funding has been provided by the Government of Zambia, DANIDA (Danish International Development Agency), KfW, European Union and AusAID. Technical Assistance is provided by GIZ (German Development Cooperation).

This fieldnote captures the DTF's sanitation implementation approach and experiences during the implementation of these first four sanitation projects and focuses on faecal sludge management aspects in particular.

2

## *The DTF Sanitation Implementation Approach*

The objective of DTF sanitation approach is to provide sustainable and hygienic sanitation services for urban low income areas, thereby enhancing the quality of life and dignity for users living in low-income areas. Further, commercial utilities will be enabled to expand their sanitation service to neglected areas.

The underlying technical principle is partly solid-free/simplified sewer based sanitation systems and robust, low-cost decentralised treatment with reuse options for nutrients and energy if applicable. 16 Biogas digesters in 3 projects (Kariba, Libuyu, Kandundu) connect up to 70 household per digester. In these biogas digesters, two treatment processes are relevant: i) settling of suspended solids, and ii) anaerobic treatment and reduction of organic load.

The overflow is solid free and small bore sewer systems with reduced flush water demand can be applied. Due to anaerobic treatment, the organic load will be reduced and biogas produced. The produced biogas can provide cooking energy for up to 50 households (anaerobic treatment of waste water from seven households, produces cooking energy for one family). Families in the proximity of the digesters are connected to the biogas system. Selection of benefiting households is done in collaboration with the Community Sanitation Committee. In the Kansuswa project two bigger conventional settlers are used as a first treatment step connecting more than 10,500 people. Secondary treatment for Kandundu is done in a combination of an Anaerobic Baffled Reactor and Planted Gravel Filter.

For Kansuswa and Libuyu, wastewater stabilization pond systems are used, and for Kariba a conventional treatment plant is used.

Faecal Sludge Management is a central aspect of this project as the biogas digesters will need to be emptied approximately once a year. Wastewater from 3,500 people will be collected in 18 biogas digesters and additional wastewater from 10,500 people in settlers, respectively. In Ndola, waste water from approximately 1,000 households is discharged into a sewer system directly. With an assumed sludge accumulation rate of 60 litres per person and year, roughly 900 cubic meters of sludge are accumulated each year.

The emptying and treatment service is a foreseen duty of the Commercial Utility. Stabilized sludge from settlers will be emptied with vacuum tankers. Further treatment of faecal sludge shall be done in appropriate treatment/drying facilities. For the Kandundu project in Solwezi, reuse of sludge after drying is envisaged through application on a nearby located banana plantation. In Zambia, dried sludge is already used in agriculture and it is sold at treatment plants.

Overall, the technological approach combines robust innovative improved sanitation solutions with ecological principles enabling reuse of resources and energy where possible. Household sanitation is in the centre of the approach, whereby public toilets in market places or bus terminals are considered as viable option for sanitation stress areas.

## *The Four Pillars of this Approach...*

### *i. Leadership by Commercial Utilities (CUs)*

CUs are legally mandated, professional water and sanitation providers and drive the implementation process. Local authorities, NGOs and CBOs are engaged for specific assignments such as community sensitisation.

### *ii. Demand driven approach*

Informed choices of selected technology options by users are considered as key for ownership. The communities are sensitized regarding the operation and contribution of different pre-selected sanitation solutions. Demand by Service providers is guaranteed as it is the CUs that propose areas and determine pre-selection of technical solutions.



### iii. Capacity building

Training workshops for community members, contractors, consultants and CU staff is carried out during implementation. Health and Hygiene awareness and sanitation demand creation is carried out by the project team throughout the project.

### iv. Financial sustainability

In order for the project to be commercially viable, a household contribution is made to initial upfront investment costs. Further, community contributions in the form of a sanitation fee is also made to the day-to-day running costs of the schemes.

## *Project Structure & Processes Followed*

Implementation starts with DTF issuing a call for proposal inviting selected CUs to submit sanitation proposals. DTF has a financing agreement with CUs and provides technical and social consultants to support implementation.

The project has a Sanitation Steering Team (DTF/WASAZA/BORDA and GIZ) which meets regularly. Each individual project has a project team consisting of members of the CU, representatives from the community, partnering institutions, constructors, local authorities and DTF staff. Regularly and rotating site meetings of all project teams are considered to review progress and share lessons during implementation.

A Community Sanitation Committees (ComSanCom) is elected in the beginning of the project. It is responsible for communication between the project team and the community. The ComSanCom is involved for security, collection of contribution and routine maintenance issues. Further, the ComSanCom avoids inequality in the way jobs are allocated to the community members and can help sensitizing the community on health benefits of good sanitation and adequate sanitation behaviour.

In terms of the process followed, the sanitation projects are now implemented in four-phased approach:

#### i. PHASE 1 – Preparatory stage

The CU and the social and technical consultant prepare a baseline report outlining the basic water supply and sanitation, socio-economic, hygiene behaviour, and geographical data of the areas where the project might be implemented. An assessment of baseline reports is the basis for DTFs funding decision.

#### ii. PHASE 2 – Proposal development

The Community Participatory Assessment (CPA) is an approach that is used to elicit

participation of beneficiary communities in the planning, implementation, construction, operation and maintenance of sanitation facilities. The same process allows the communities to be involved in the choice of the sanitation technology option based on the funds available, future sanitation sustainability, convenience and affordability. After CPA, a simple feasibility report is available, which is the basis for phase

### iii. PHASE 3 – Detailed proposal development

The procurement plan for consultancy and detailed engineering designs is developed. CUs submit an investment proposal (including tender documents, engineering drawings and costs) to the DTF evaluation team which evaluates them, ranks the best proposals, and presents those to the DTF Committee for financing approval.

### iv. PHASE 4 – Implementation

Project implementation is done by the CUs, whereby parts might be contracted out. The supervision of work is done by the CU supported by a technical and social DTF consultant or alternatively an external engineering firm is engaged to supervise the works.

## 3

### *Implementing The Four Projects*

As mentioned earlier, the DTF started the implementation of four sanitation projects with four Commercial Utilities in 2009.

The four are:

- Kafubu Water and Sewerage Company (KWSC)
- North Western Water and Sewerage Company (NWWSC)
- Southern Water and Sewerage Company (SWSC)
- Mulonga Water and Sewerage Company (MWSC)

Faecal Sludge Management is central to these projects as the biogas digesters will be emptied approximately once a year. Altogether, waste water from 3,500 people will be collected in 16 biogas digesters and waste water from 10,500 people in two large settlers. In Ndola waste water from ca. 1,200 households is discharged into a sewer system directly. With an assumed sludge accumulation rate of 60 liters per person and year, roughly 900 cubic meters of sludge are accumulated each year.

Below is an overview of the four projects.

Project, Town	Users	Annual FS (m <sup>3</sup> )	Waste Water Treatment System	Faecal Sludge Management Components
Kandundu, Solwezi	1,000	60	5 biogas digesters (4 immediate and 1 central before Anaerobic Baffled Reactor and Planted Gravel Filter	Emptying biogas digesters, sludge drying, reuse locally
Kansuswa, Mufulira	10,500	630	2 settles and stabilization pond system	Pond desludging
Kariba, Ndola	2,000	50	2 Biogas Digesters connecting 144 households while 207 households discharge directly into sewer, and treatment at conventional treatment plant	Emptying biogas digesters, sludge drying
Libuyu, Livingstone	2,800	170	9 biogas digesters, stabilisation pond system	Emptying biogas digesters, sludge drying, reuse locally

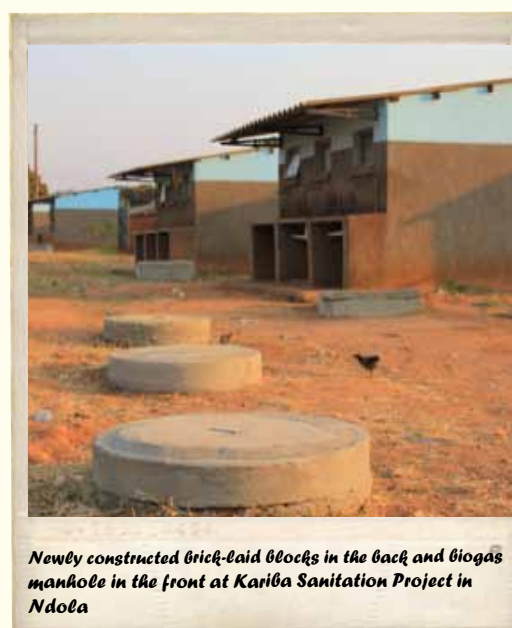
Overview of the four projects

## 1) Kariba Sanitation Project, Ndola

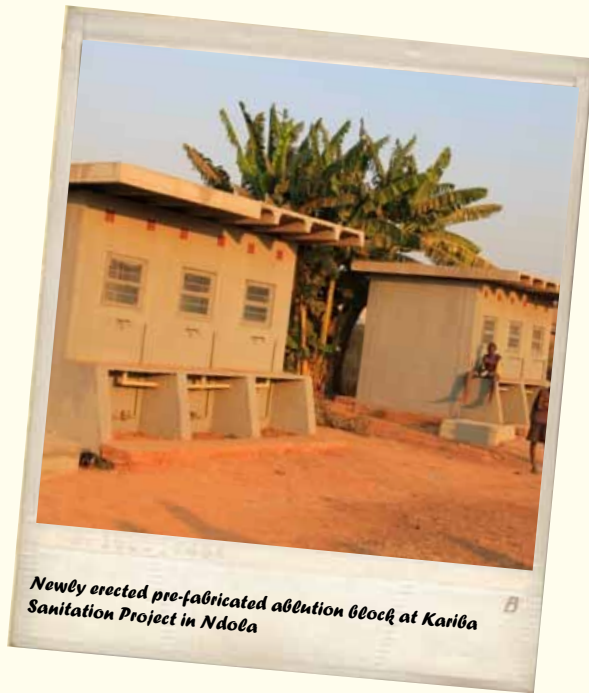
The project is implemented in collaboration with Kafubu Water and Sewerage Company (KWSC) and has been operational since late 2011.

It is located in Kabushi Township of the city Ndola, in an area called Kariba. The area is a typical low-cost settlement that was set up in the mid-1940s. At the beginning of the project it was serviced by communal ablution blocks, which were dilapidated over time. To cope with the situation, households constructed simple pit latrines in front of their houses.

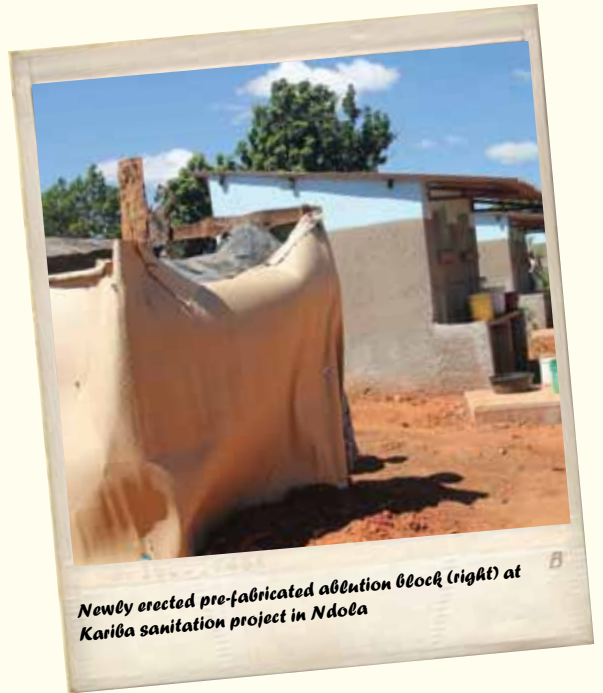
The project scope involved the construction of 4.7km of sewerage network and 1.2km of water supply network. Two large biogas settlers were constructed to collect and treat the waste water and sludge before effluent is discharged







*Newly erected pre-fabricated ablution block at Kariba Sanitation Project in Ndola*



*Newly erected pre-fabricated ablution block (right) at Kariba sanitation project in Ndola*

into the main sewerage network. In total, 351 toilets were constructed comprising 54 pre-fabricated and 99 mason brick laid ablution blocks (up to 3 separated toilets and showers per block). In total water and sanitation services are brought to 2,000 people.

## **2) Libuyu Sanitation Project, Livingstone.**

The project is implemented with Southern Water and Sewerage Company (SWSC) and will be operational in June 2013. The project area is located in Libuyu Township which is situated on the eastern side of the city of Livingstone.

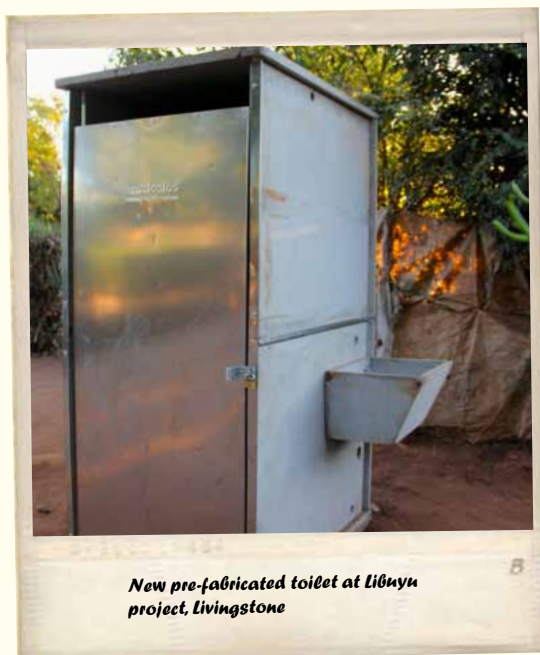
The area is a well-planned, with houses built on demarcated plots. The majority of residents are informally employed and involved in various income generating activities such as cross-border trading, transportation, housekeeping jobs and other temporary jobs. The township has approximately 10,000 residents. The project targets 2,730 people in the first phase. A second phase might be considered at a later stage.

The project is intended to replace the dilapidated pit latrines and septic tanks in



*Old & dilapidated pit latrine at Libuyu project, Livingstone*

the township, and supply 390 new pour-flush sanitation facilities (260 prefabricated and 130 conventional toilet units) with sewer based sanitation. It further involves the extension of the sewerage network by about 5 km and construction of 9 biogas settlers which enable a solid-free sewage system and produce biogas for approximately 20 families. The project also includes the construction of a sewerage pump station from where the waste water is pumped into a central stabilization pond system.



### ***3) Kandundu Sanitation Project, Solwezi.***

The Kandundu project is implemented in collaboration with the North-Western Water and Sewerage Company (NWWSC) and has been operational since December 2012. The project area is located in the fast-growing (mining) town of Solwezi, which was previously characterized by sewage spillages due to a dilapidated sewer network and communal septic tanks. The Commercial Utility has occasionally eased the situation using a mobile vacuum tanker.

The project involves construction of 3.1 km of sewerage network, connection of 120 households to the sewer network, construction of 5 intermediate biogas settlers in selected sections of the network, construction of an Anaerobic Baffle Reactor (ABR) with a main collector biogas settler and a Plant Gravel Filter (PGF). Households use toilets inside their houses and in total the project covers sanitation services for more than 1,000 people.



*Typical household with new toilet (right) at Libuyu project, Livingstone*

### ***4) Kansuswa Project, Mufulira.***

The Kansuswa project is implemented in collaboration with Mulonga Water and Sewerage Company (MWSC) and has been operational since December 2012.

Kansuswa Township is located in the south-eastern side of Mufulira Town. In total, there are 657 houses in New Kansuswa and 301 houses



*Construction of decentralised waste water treatment system at Kandundu project in Solwezi*

in Old Kansuswa. The houses in new Kansuswa have flush toilets inside the houses.

The sewerage network and the stabilisation ponds in Kansuswa had been out of use for over 15 years prior to the start of this project. Due to lack of maintenance, the sewerage system collapsed resulting in blockages and spillage of sewerage in the township.

The project involves construction of 13.7 km of sewerage network, rehabilitation of two interceptors and pond stabilisation system, as well as construction of several manholes on the sewerage network.



## Sustainability of the projects

The CU drives the project and is responsible for service delivery after completion. Routine maintenance can be done by a trained community based organization with a contractual arrangement with the CU. Major maintenance and repair shall be done by the Commercial Utility. Project implementation costs are substantially subsidized to enable the poorest to benefit from the sanitation system.

A monthly sanitation fee is applied to finance maintenance and Faecal Sludge Management activities. Currently the tariff is envisaged to be between 20 and 30% of the water tariff, though initial analysis indicates that full operating cost could only be recovered applying a higher sanitation tariff. Tariff adjustments and cross-subsidy is therefore needed from economically better situated water customers. Additional revenues from reuse of sludge might contribute to maintenance costs. Households receiving biogas as cooking energy are supposed to pay a monthly fee of an equivalent of about 6 USD.

4

## Lessons Learnt

- **Stakeholder capacities**

During the implementation it has been recognised that sanitation projects require more capacities within all project stakeholder institutions than water projects. Limited capacities, changes in procurement procedures, inadequate sewer design plans and slow pace and quality of contractors led to delayed project implementation. Projects need, particularly in the final phase, continuous pushing and concerted effort until the last meter has been built.

- **Project time frames & Community Support**

Delayed implementation reduces motivation of communities to support the project, ensure security of materials and contribute financially. Generally households have the willingness and ability to contribute, even when available finances are in competition with basic needs. It is important to mention from initial interactions with the communities that the projects will only be executed if households contribute to the project cost. It is found as a practical contribution method, if households contribute, and later deduct from the house rentals. Landlords are found to develop interest to increase the value of their property during the project and thus reduction of contribution from the rent is a sure way of household contribution collection, and are thus a sure way of ensuring household contributions to the project.

- **Communication and Relations with communities**

Development projects raise a lot of expectation within the community. Communication and relations with the communities need to be managed carefully. If implementation does not go perfectly, it is possible for the community to speak out against it, and hinder its success. The formation of a Community Sanitation Committees is very useful for communication and liaising with the communities.

- **Project Management**

The project steering group needs to meet regularly to discuss and solve problems immediately. The engagement of local authorities from the beginning is crucial especially for enforcement of by-laws and land issues.

- **Budgets**

Budget amendments were necessary due to design revisions that were necessary to resolve technical challenges on the structural and civil works as well as process design. Implementation of improved sanitation facilities require sufficient funding. The average total project cost of the first call is ca. 200 USD per person.

- **Selection of contractors & Site Inspection**

Selection of contractors needs to be done carefully. Usually the qualification on paper does not meet the required capacity on the construction site. Thus, physical inspection of construction sites and personnel interaction with the contractor and his clients is crucial to assess his real capability before a contractor is engaged. Further contractors tend to have cash flow problems and advance payments partly in materials and cash for mobilization only might have to be considered. Contractors might use advance payments for other projects. Further, the capacity of both the public and private sector for planning and implementing sanitation projects in Zambia is generally low. Stringent supervision and close project management is thus crucial for ensuring quality of works and timely completion.

- **Capacity Building**

In view of the low capacity of both the public and private sector for planning and implementing sanitation projects, technical assistance and facilitation of information exchange between the project implementers is crucial for capacity building. Local trainings and exposure to international trainings can help to raise the profile of the sanitation managers in utilities and create enthusiasm to work on the sanitation challenge.

5

## *Conclusion & Way Forward*

The DTF finances the largest sanitation portfolio in Zambian urban low-income areas currently. Sanitation projects are complex and require dedicated time and resources. Project implementation provides plenty capacity building opportunity for all project partners.

Households are willing and can contribute to the project costs more substantially. A significant part of toilet costs shall be financed by households or landlords. Sanitation marketing, consistent communication and engagement of local leadership is crucial. Usually legal enforcement of sanitation relevant by-laws is not effective in low-income areas. Therefore integrated planning and engagement of local authorities is a crucial element for project success.

Business models around the sanitation chain exist (e.g. design, construction, supervision of projects, private pit emptier). The private sector can play a crucial role, though usually access to finances is a challenge for them. The marketing of human manure and biogas has good potential in Zambia, though currently, only limited commercial orientation on sanitation in general and its potential of revenue generation by activation of reuse chain can be recognised in Zambia.

In August 2012 the DTF launched a second call for proposals inviting seven commercial utilities to submit project proposals with a focus on peri-urban areas. In March 2013 baseline surveys on eight areas started. The second call aims at sanitation provision for 30,000 people.

## 6

### 6. More info

[www.dtfwater.org.zm](http://www.dtfwater.org.zm)

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