sustainable sanitation alliance

Case study of sustainable sanitation projects

Public toilet with biogas plant and water kiosk Naivasha, Kenya

Fig. 1: Project location

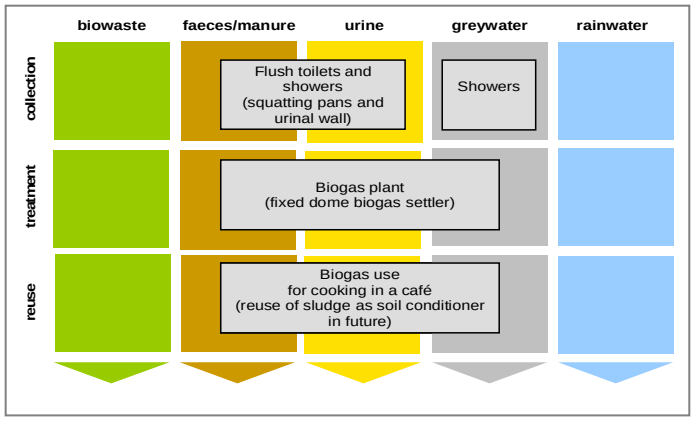

Fig. 2: Applied sanitation components in this project

1 General data

Type of project:
Urban pilot and demonstration project

Project period:
Start of construction: Oct 2007
Start of operation: July 2008
Ongoing monitoring period until May 2010

Project scale:
300 visitors to public toilet per day (design figure was 1000 visitors per day)
Total investment EUR 40,000 (public toilet with 5 toilet cubicles and 2 showers, biogas plant and water kiosk)

Address of project location:
Naivasha Bus Park in Naivasha
Kenya (Rift Valley region)

Planning organisation:
EU-SIDA-GTZ EcoSan Promotion Project, Kenya (supported by the EU, SIDA, GTZ and embedded in the Kenyan Water Sector Reform Program)

Executing institution:
- Water Service Provider (WSP): Naivasha Water, Sewerage and Sanitation Company Ltd. (NAIVAWASS)
- Water Services Board (WSB): Rift Valley Water Services Board
- Water Services Trust Fund (WSTF)

Supporting agency:
- European Union (EU) – ACP EU Water Facility
- Swedish International Development Agency (SIDA)
- German Technical Corporation (GTZ) on behalf of German Federal Ministry for Economic Cooperation and Development (BMZ)

2 Objective and motivation of the project

The “EcoSan sanitation project” in Naivasha had the following objectives:
- To improve the living conditions of the residents and travellers by providing safe and environmentally-friendly sanitation solutions with a focus on the reuse of the human waste as a resource (ecological sanitation or ecosan).
- To find a business-orientated solution that creates economic incentives for the water sector institutions to invest in sanitation and to generate income for private operators.

The overall aim was to achieve sustainability through capacity building within the institutional water sector institutions towards professionalism, efficiency and commercialisation. The focus of this document is the public toilet; the water kiosk system is also briefly described.

Fig. 3: View of Naivasha bus park with the public toilet at the front of the plot (behind the large bus); during the construction in mid 2007. All photos in this document by C. Rieck (GTZ) in 2008/2009.

Public toilet with biogas plant and water kiosk Naivasha, Kenya

3 Location and conditions

Naivasha is a small town located at the shores of Lake Naivasha about 80 km north of Nairobi. The town covers an area of 30 km^2 and has a population of approx. 70,000 people. The excreta management in the town relies mainly on pit latrines. Less than 5% of households and businesses are connected to the sewer system which is connected to a poorly functioning wastewater treatment plant.

The town has five public toilets (at markets and bus stops) with flush toilets and sewer connections. They are managed by the municipal council and are in an appalling state because:

- There is no operation, maintenance and management concept for these toilets.
- The water supply to the toilets is only erratic.
- The toilets are frequently blocked and overflowing with human waste.
- The surrounding environment and the buildings are not maintained or kept clean.
- The municipal council is not showing any interest in these facilities since they are not generating any revenue that could be used to cover costs for operation and maintenance (there is no user fee).

To deal with the water and sanitation problems in Naivasha, a Water Service Provider (WSP) which is called Naivasha Water Sewerage and Sanitation Company Ltd. (NAIVAWASS) was formed under the Water Sector Reform Program of the Ministry of Water and Irrigation (MWI) a few years ago. The responsibility for water and sewerage was shifted from the Municipal Councils to the regional Water Services Boards (WSB) who delegates the management to the local WSP.

Public toilets are still a responsibility of the municipal councils according to the regulations of the local government, but may be handed over as well to the WSB/WSP.

The Ministry of Water and Irrigation (MWI) has committed itself through the Water Sector Reform Program to facilitate the improvement of water supply, sewerage and sanitation service provision in Kenya. GTZ is supporting the Kenyan Water Sector Reform Program through its Water Program which has five components. One component is the **EU-SIDA/GTZ EcoSan Promotion Project (EPP).**

The EPP, which ran from end of 2006 to mid 2010, is a project financed by the **ACP-EU Water Facility**[1] (EUR 1,734,137) and is co-financed by SIDA (EUR 815,842), GTZ-Kenya Water Program (EUR 100,000) and GTZ-Kenya Agriculture Program (EUR 100,000). It piloted sustainable sanitation projects in rural households[2], public places, public institutions and informal settlements.

Naivasha Bus Park was selected for a pilot public sanitation project combined with a water kiosk. The project was implemented through established institutions of the Water Sector Reform Program (Water Service Board, Water Services Trust Fund and Water Service Providers) in order to ensure sustainability in service provision.

The infrastructure was funded by EPP. The funds were channelled through the Water Services Trust Fund (WSTF) which is a basket fund for pro-poor service provision of water supply and sanitation. Rift Valley Water Services Board is the designated asset holder of the infrastructure while the responsibility to operate and manage the facility was given to the assigned local Water Service Provider (WSP), which is here the Naivasha Water, Sewerage and Sanitation Company Ltd. (NAIVAWASS).

The WSP has selected, contracted (for one year) and trained a private operator who runs the facility on a day-to-day basis. The operator is a Community Based Organisation called Banda Livestock Self Help Group. Usually two persons are working, one of them continuously cleans the facility and the other one operates the public toilet and water kiosk.

Naivasha Bus Park is located in the town centre. It operates 24 hours per day for overland buses. The old existing public toilet was poorly maintained by the municipal council. Approximately 200 people used the old public toilet per day (for free). The users were travellers on stop overs and business people from the shops within and around the bus park. The bus park is surrounded by residential areas where households mainly depend on individual or shared toilets. The water supply situation is characterised by unreliable water supply and insufficient quantities supplied (partly due to power shortages).

In Kenya, the under-five child mortality rate is currently[3] **128 children per 1000**, and sadly there has been a slight but consistent upward trend towards more child deaths since about 1985 when the value was 98 child deaths per thousand.

Fig. 3: New public sanitation facility with water kiosk (left side). Underground biogas plant in front.

[1] ACP-EU stands for Africa, the Carribean, the Pacific and the European Union. This project was funded under the first call of the first water facility in the category of "improving water management and governance" and "Co-financing water and sanitation infrastructure" in September 2006. http://ec.europa.eu/europeaid/where/acp/regional-cooperation/water/

[2] See also the case study for UDDTs in Ugunja, Western Kenya http://www.susana.org/lang-en/case-studies/region/ssa

[3] The under-five mortality rate is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of five if subject to current age-specific mortality rates (http://www.childinfo.org/mortality.html and http://www.childmortality.org/).

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4 Project history

Prior to 2007, the Water Services Trust Fund (WSTF) was only funding urban water supply projects as well as rural water and sanitation projects in Kenya. From 2007 onwards, it broadened its funding activities to also include sanitation in urban areas. The pilot project in Naivasha Bus Park was the first project in public sanitation aimed at developing appropriate procedures for funding and implementation of such facilities. EU, SIDA and GTZ provided the funds for implementation (hardware and software) that were channelled through the structures of WSTF. The Ecosan Promotion Project (EPP) acted as a support organisation in project preparation, implementation supervision and training activities.

The implementation procedures were adopted from the water supply projects that the WSTF is already funding such as standpipes and water kiosks. The sanitation facility was planned with the Water Services Board (WSB), the local Water Service Provider (WSP) and municipal council in early 2007. The technical design was done by the EPP. The EPP, WSTF, WSB, municipal council of Naivasha and the WSP formed a project task force and jointly developed the sanitation concept. A Memorandum of Understanding was signed between the WSB, WSP and municipal council to avail the site for the facility to the WSB. Then a final sanitation project proposal was presented to the WSTF for approval.

The public sanitation facility and a water kiosk were constructed adjacent to the bus park (next to the old public toilet which was demolished afterwards). The land is owned by the municipal council and availed through the MOU to the WSB.

After approval by WSTF, the funds were disbursed to the WSP in batches to execute the work according to work progress. First the WSP invited pre-qualified companies to tender for the construction works. The WSP awarded the tender, and supervised the construction works with assistance of the EPP, WSTF and WSB starting in October 2007. The completion of the facility was certified by EPP, WSB, WSTF and WSP and then handed over to the Rift Valley Water Services Board as the asset holder in late 2008.

The WSP selected a private operator, who was then trained by the WSP and WSTF on the operation and maintenance concept. Furthermore a sustainable operation and management system was put in place to ensure that the facility generates enough revenue to finance its operation and maintenance costs (see Section 9).

The construction period was from late 2007 to late 2008. The construction was repeatedly delayed due to poor construction quality and poor construction supervision by WSP. Moreover the post-election violence in Kenya in the beginning of 2008 caused further delays of several months.

The new sanitation facility at the Naivasha Bus Park was put in operation after handing over to the WSB in July 2008. During the start-up phase of operation the project partners were continuously supporting and consulting the WSP in terms of optimising the operation and maintenance of the toilet and biogas plant. Moreover the EPP and WSTF are now monitoring the performance of the facility and assist in further training if necessary. (note the EPP finishes in May 2010)

5 Technologies applied

The main reasons for choosing the technology of biogas sanitation for this project was to demonstrate that biogas production from human waste is possible under Kenyan conditions. The technology was not selected to be the cheapest alternative but to show that sanitation can be "productive". Further treatment of the wastewater could be done through baffled reactors and anaerobic filters, but available space was limited and instead a sewer connection was available.

Another alternative technology for this location would have been urine diversion dehydration toilets (UDDTs). However the situation in Naivasha with piped water supply, a habit of using flush toilets and existence of a sewer connection offered only few incentives for dry toilets. Therefore water-based sanitation was favoured especially in terms of social acceptance.

The new facility comprises a sanitation unit (toilets, handwash basins, a urinal and showers) and a water kiosk. The facility is connected to the town water supply network and has three overhead water storage tanks to cater for short supply interruptions. The wastewater from the toilets, showers and hand wash basins is drained into an underground biogas plant that treats the wastewater an-aerobically (under the absence of oxygen) on-site. Treated effluent is discharged to the sewer[4].

Fig. 5: Customers of the water kiosk. The water tank on the roof holds 5 m^3 (or 250 jerry cans) to bridge water supply gaps for a period of about 1-2 days.

There are in total 5 toilet cubicles (2 for males and 3 for females), 2 showers and one wall for urinating. The water is provided through 2 overhead water storage tanks (each 5 m^3) placed on the toilet roof. The water kiosk has a separate overhead water storage tank on its roof.

When an overland bus stops at the bus park an average of 5-20 people come to use the toilets at once. Men mostly use the

[4] Note: in other settings, local reuse of this treated effluent in agriculture could be possible.

urinals whereas women have to wait a little longer to use the toilets.

The water kiosk is located in front of the toilet building and sells water and other commodities. It also serves as the operator's room. The operator collects user fees, hands out toilet paper, sells other toiletries and cleans the facility.

Water-flushed toilets and urinals

The toilets are fitted with locally available standard ceramic squatting pans (without urine diversion). They were initially flushed with 10 L of water from locally available 10 L cisterns above the toilet. Due to shortage of water and repeated breaking of cisterns, the toilets are currently flushed by hand with a "pour flush" system. A small bucket is filled with 2-4 L of water taken from a small drum and is then poured into the toilet.

Fig. 6: Left: Urinal using a tiled wall (no door) with optional water flush. Right: Squatting pan with 10 L cistern (flush toilet); but these days a manual pour flush system is used for toilet flushing (see Fig.7).

Fig. 7: Pour flush system with small bucket (2-4 L) in drum. The small bucket is used to flush the toilet.

The urinal consists of a tiled wall and trough with flushing device connected to a 10 L cistern. But the urinals are rarely flushed due to water shortage, hence odour develops occasionally. The operators clean the urinal wall and trough on an irregular basis.

Showers

Shower heads were installed in two cubicles to provide cold showers. Hot water is usually not offered in public toilets in Kenya. Even if hot water showers were offered, the users would probably not be willing to pay extra for it.

Biogas plant (or "biogas settler")

All the generated wastewater from the toilets, urinals, showers and hand wash facilities is discharged into an underground 54 m^3 fixed-dome biogas plant where the (quite dilute) wastewater is treated through settling and anaerobic digestion thereby lowering the organic content (pollution load) of the wastewater. Biogas is produced in the process.

The biogas plant has two outputs: treated effluent (continuous flow) and sludge (emptied once per year). Settling of solids occurs in the main chamber (or dome-shaped reactor).

The treated effluent from the biogas plant is drained into the existing public sewer line running along the nearby road. The reduction of organic load through the anaerobic treatment process is contributing to the protection of Lake Naivasha as the treatment efficiency of the existing wastewater treatment plant (pond system) at the end of the sewer pipes is very poor. If more such biogas plants were built, there could be a noticeable effect.

The accumulated sludge is removed once a year and can be used as fertiliser (see Section 7).

Biogas piping

The biogas is piped (half inch galvanised iron pipe, i.e. 1.5 cm diameter) to a nearby café where it is used for cooking (5 meters away). A water trap chamber was installed next to the biogas plant to collect condensed water in the pipeline. There is a main valve at the gas outlet point outside next to the dome and a secondary valve inside the café before the stove. Attached to the piping in the kitchen is a simple manometer consisting of a water-filled transparent pipe to indicate the pressure in the system. This pressure shows the actual amount of biogas available for use (see Section 7).

Fig. 8: Area of the top manhole (above biogas fixed dome) of the biogas plant. Clay is used for sealing the lid, and water to keep it wet and thus detect leakages that would show up as bubbles.

Biogas appliances

A biogas stove was fitted onto a stand. The stove was placed inside the kitchen area of the café for cooking food and making tea. A regular LPG stove can be converted to biogas by changing the gas-to-air ratio.

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Water kiosk

The water kiosk design was developed by the WSTF and has been successfully implemented in Kenya and other African countries (see Section 13 for reference).

The water kiosk uses an overhead tank of 5 m^3 to bridge water shortages. A total of three water outlets are operated from the inside with valves. The kiosk is used as the operators room to serve the toilet customers and to sells toilet paper, other toiletries, cleaning utensils and other items.

Steel window shutters and doors protect the kiosk from theft and vandalism when it is closed. Hence the operator can safely store items and documents. The water meter for the water consumption is placed outside in a metering chamber jointly with the water meter for the toilet. The operators check the meter once a day for their own documentation. The WSP reads the meter once a month.

6 Design information

The biogas plant has a volume of 54 m^3 with two expansion chambers. The underground structure is located about 0.5 m below surface. The required area for the toilet building and biogas plant is approximately 10 x 15 metres. It is not recommended to build any structures on top of the biogas plant.

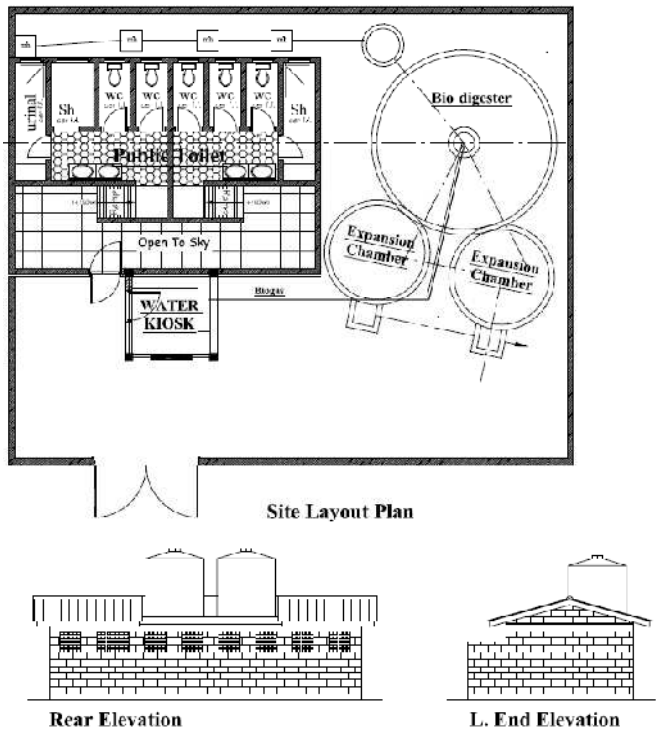

Fig. 9: Technical drawing of the facility and biogas plant (source: EPP). Space requirement for toilet and biogas plant is approx. 10 x 15 m.

Design parameters for the biogas plant assume 1,000 visitors per day. The dimensions of the plant were based on a sufficient settlement of solids which is achieved with a hydraulic retention time (HRT) of 5 days[5]. The solids settle and remain in the system for digestion and biogas production. The system works like a gas tight septic tank. The solids-free effluent is flowing over to the sewer connection.

This project did not focus on sanitising und treating the effluent for agricultural reuse since (i) the available space for further treatment was not available and (ii) there was no demand for irrigation water in the area.

The design of the fixed dome was based on the system implemented for livestock manure in Kenya by the GTZ-PSDA program (Promotion of Private Sector Development in Agriculture).

This type of fixed-dome biogas plant was selected due to its robust technology that works without moving parts. It is able to operate with inflow fluctuations caused either by lack or overuse of water. The production of biogas is continuous and the fixed dome technology provides for biogas storage. The pollution reduction in terms of BOD decrease is expected to be 30-40%. Measurement results are not yet available.

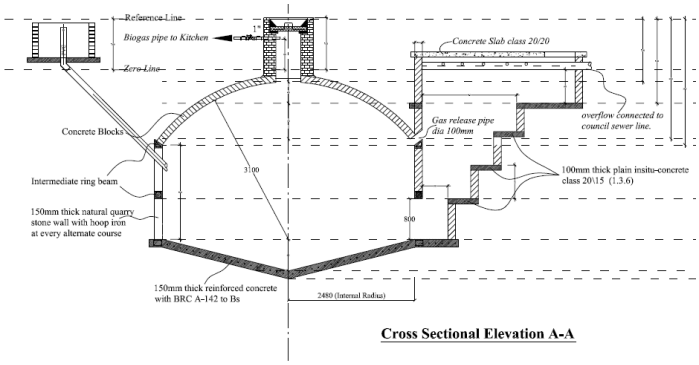

Fig. 10: Technical drawing of the biogas plant (built completely underground). Diameter of dome-shaped digester is 5 m. See section 13 for links to further drawings (source: EPP).

7 Type and level of reuse

The reuse of human waste comprises the use of biogas, settled sludge (slurry) and effluent water:

- Biogas is generated from the anaerobic digestion process carried out by micoorganisms. It can potentially substitute firewood, charcoal and Liquefied Petroleum Gas (LPG). The biogas from the Naivasha sanitation facility is used for cooking by a nearby café. The café owner is cooking tea and snacks during the whole day for about 50 customers. When there is excess gas it is ventilated (flaring would be preferable but is difficult to achieve at the small scale). Advantages of biogas as a cooking fuel are the smokeless and fast cooking compared to charcoal.[6].
- The settled sludge shall be used as a soil conditioner in the future. The Water Service Provider can use its treatment facility grounds to dry and compost the sludge for production of soil conditioner.

[5] This corresponds to a design flowrate of 11 m^3/d or 11 L/person. The current flow rate is not measured but is about 1.5 m^3/d (if 300 people per day use 5 L per person). Therefore, the current HRT is 36 days.

[6] It would theoretically be possible to install a generator to produce electricity, but the quantity of biogas produced here is not sufficient for a reliable production of electricity.

- The treated effluent (from the outlet of the biogas plant) could be used as a source of fertiliser and irrigation water, however it is not feasible here due to long transport distance to suitable agricultural areas.

Fig. 11: The café that uses biogas for cooking is located adjacent to the public toilet.

8 Further project components

The lessons learnt from this project now form part of the new implementation procedures for urban projects being finalised by the WSTF, called Urban Project Cycle.

The combination of the public toilet with a water kiosk was an additional service provision that was being tested in Naivasha. The water kiosk is not important for travellers but interesting for surrounding businesses and residents. So far there is positive feedback from the customers and the facility operator.

9 Costs and economics

The investment costs for the entire facility was approx. 40,000 EUR. A cost breakdown was not available at this time from the WSTF. The costs included material and labour costs for the ablution block, water kiosk, biogas plant and administrative costs for the supervision work of the Water Service Provider (here: NAIVAWASS). The WSP was responsible for construction, supervision, trainings and mobilisation. The funding came from the Water Service Trust Fund, a basket fund supported by Kenyan Government, donors and development partners[7].

The annualised investment costs are approx. 0.05 Euro per visit based on 9,000 visits per month, a life span of 10 years and a discount rate of 5%. The average operation and maintenance costs are illustrated in Table 1.

The financial sustainability of the facility depends on the number of users and the water and the toilet/shower tariff and the other operation and maintenance costs. Currently an average of 300 people uses the toilet and about 200 customers are buying 200 jerry cans (each 20 to 22 litres) of water from the water kiosk.

[7] The main donors are currently e.g. BMZ through KfW and GTZ, SIDA, DANIDA, UNICEF and World Bank

Table 1: Average annual operating costs and revenue from public toilet facility and water kiosk **for the operator** (based on 300 toilet users and 200 water kiosk users per day).[a]

Average annual costs per annum for operation	**Expenses in EUR/a**
Salary of toilet/kiosk operator (220 EUR/month)[b]	2.640
Salary of toilet assistant (110 EUR/month)[b]	1.320
Water for toilet – currently at 2.1 cbm per day or 7 liters per customer (water retail tariff of 0.80 EUR per 1000 liter); paid to WSP	613
Water for kiosk - average of 4 cbm per day (special subsidized tariff of 0.30 EUR per 1000 liter); paid to WSP	438
Meter rent (2x 50 KSh for nominal size of meter up to 20mm); paid to WSP	12
Sewer costs for toilet/digester effluent (75% of water retail tariff)[c]; paid to WSP	460
Rent of facility (50 EUR/month); paid to WSP	600
Electricity (2 KWh/day á 0.17 EUR/KWh)	124
Toiletries (toilet paper, mops, soaps etc.)	450
Painting (half-year) of toilet facility	200
Plants, greenery, staff uniforms	N/A
Coupons, tickets, cashbook and so forth	10
Electrical fixtures and minor plumbing like water taps etc. (replacement)	100
Mirrors and other equipment	25
Costs for disposing waste from dust bins	20
Average total operation costs	**7.012**
Average revenue per annum for operator	
User fee revenue (current average of 295 toilet user per day; 0.05 EUR per toilet use, 5 shower users; 0.10 EUR per shower use)	5.566
Selling of water (average 4 cbm[d] per day at 0.02 EUR/22 liter jerry can)[e]	1.327
Additional income through selling activities, shoe shining, credit etc. (10 EUR per month)	120
Average total revenue for operator	**7.014**

[a] The living costs in urban areas like Naivasha are estimated at EUR 100 per month

[b] The income increases with the revenue of the operator

[c] For future installations sewer fee could be reduced because of lower organic load

[d] Corresponds with 200 people using the water kiosk, if each person buys one jerry can of 20 L per day.

[e] Allowance for 20 litre containers that take 22-23 litres (standard expansion contingency in such containers)

The current opening hours are only during day time from 6:30 am to 7:00 pm.

Tariffs: The Naivasha Public Toilet charges for the use of the toilet 5 Ksh[8] (0.05 EUR), for use of the shower 10 Ksh (0.1 EUR) and for a 20-22 litre jerry can of water 2 Ksh (0.02 EUR). These tariffs were proposed by the WSP. The Water Services Board (asset holder) and the Water Services Regulatory
Board (regulator) can adjust these tariffs if required. The operator is not allowed to raise the price of water and sanitation services. The price setting is meant to be pro-poor.

The operator pays a subsidised water tariff to the WSP of 0.3 EUR per m^3. At the same time he/she makes 1 EUR per m^3 from the sale of water thereby making a profit of 0.70 EUR per m^3. For the water used in the toilets the operator pays the standard retail price of 0.8 EUR per m^3 since he/she collects a toilet user fee to cover his costs for toilet operation.

The calculation in Table 1 shows that a sufficient income for the operator is possible to cover the operation and maintenance costs. In case the facility gets connected to the electricity grid, the opening hours could be extended and more customers attracted. This could influence the economics of the facility positively. The same stands for increased numbers of customers.

Table 2: Annual operation and maintenance cost, revenue and profit of **Water Service Provider** (based on 300 toilet users and 200 water kiosk users per day).

Average operation and maintenance costs for the Water Service Provider	**Expenses in EUR/a**
Operation costs:	
Producing and distributing water (approx. 0.35 EUR per m3)	780
Employment costs for inspecting visits (quarter hour per week)	150
Maintenance costs:	
Replacement of equipment	500
Plumbing maintenance toilet	200
Miscellaneous	200
Yearly Desludging/maintenance costs for Waste Water Treatment (executed by WSP)	100
Annual O&M costs for WSP	**1.930**
Average revenue per annum for Water Service Provider	
Water revenue, Sewer fee, water rent (see table above)	1.523
Rent of facility (see table above)	600
Biogas revenue (approx. 10 EUR per month) - - not yet utilized	-
Advertising revenue (approx. 20 EUR per month) - not yet utilized	-
Total revenue Water Service Provider	**2.123**
Annual total of Water Service Provider	**193**

The use of biogas will be charged by the WSP after the current trial period. The WSP plans to charge 10-15 EUR per month to cater for operation and maintenance costs for the biogas plant and a profit margin. This is less compared to the costs the café is currently paying for traditional charcoal costs. The café owner will sign a "Biogas Utility Management Contract" with the WSP which state roles and responsibilities of the two parties.

The Rift Valley Water Services Board aims at cost recovery only for operation and maintenance cost (but not re-investment costs). Approximately 1,930 EUR per year is necessary to cover operation and maintenance costs for WSP (see Table 2). The revenue for WSP is approx. 2,123 EUR which leads to a profit of 193 EUR. The cost figures in Table 2 are based on 300 visitors per day, but the capacity of the biogas plant is 1,000 visitors per day. If visitor numbers go up, the profit would also go up.

Re-investment costs are normally also part of an economic analysis, but in this case they are not considered because of the pro-poor approach of the WSTF funding policy. Future re-investments would have to be cross-subsidised via wealthier population segments.

10 Operation and maintenance

As mentioned above, the WSP licensed a private operator to run the facility as a business on a day-to-day basis. The operator can be either a private entrepreneur or a local Community Based Organisation (CBO). In Naivasha the CBO called Banda Livestock Self Help Group was selected and signed a renewable one year-contract with the WSP. Thus, the operator is not an employee of the WSP. The local authority is not involved in the management of the facility.

The operator and the staff of WSP were trained by the WSTF prior to commencement of operation. A facility management concept has been developed by the WSTF and is applied by the WSP.

The operator cleans, maintains, attends to, opens and closes the Public Sanitation Facility and carries out all other associated tasks to the satisfaction of the WSP. Customers pay on a pay-per-use basis. The operator has to be present during opening hours (currently 6:30 am to 7 pm), carries out minor repair works and provides for the safety of the users and facility day and night. The operator pays the water bill and rent to the WSP and also pays other operation costs (see Section 9). This is stipulated in the renewable one-year contract including penalties for bad performance. Currently two people work at the facility (one to deal with customers, one for cleaning).

The WSP is supervising the facility on a weekly basis in terms of technical conditions and operation quality. The maintenance of the toilet (beyond daily simple maintenance) is the shared responsibility of the WSP and the WSB. This includes major maintenance and repair works, which are not the result of normal wear and tear but are caused by accidents, improper use or acts of vandalism. The maintenance also includes the yearly sludge removal from the biogas plant as well as the maintenance of the biogas piping.

[8] Ksh is Kenyan shilling – approx. 100 Ksh equal 1 EUR (2009)

11 Practical experience and lessons learnt

After one year of operation, the toilet and water kiosk are delivering convenient, safe and affordable sanitation and water services. The new water kiosk and public toilet currently has approx. 9,000 visitors of the facility (for toilet, shower and/or water kiosk) per month, with 7,500 of these visits being from travellers and 1,500 visits from regular users. This is monitored through the book keeping of the operators.

On a daily basis an average of 300 users currently visit the public toilet, out of which are 250 travellers and 50 regular users from the businesses activities around the bus park. The new public toilet has drastically improved the hygienic conditions at the bus park. It also provides an income to the private sector (operator) and to the WSP.

The success factors of this project were:

- The pay-per-use concept is appropriate to supply convenient services to the user through an operator.
- The operators were trained on their job responsibilities before they were contracted.
- The facility was designed to generate enough revenue to make it attractive to the WSB and WSP.
- Best use of biogas is in small restaurants and cafés where food and hot drinks are prepared. The use of biogas for heating water for showers was initially planned but there was low demand by customers for hot showers; biogas use for lighting is considered too complicated (operation and vandalism issues)
- The management and ownership of public toilets were linked to the water sector institutions and the privatised Water Service Providers in order to enhance sustainability of service provision. Experience has shown that town and municipal councils in Kenya generally have difficulties in appropriately managing such facilities.

Fig. 12: Biogas is used to cook snacks and tea at the adjacent cafe.

Challenges for the project were:

- The development of a business plan and management concept for an intended project by WSP/WSB was not done in detail. It should be done at the project preparation phase. This way it prepares the WSP/WSB to fulfil their mandates and helps to ensure sustainable service provision.
- The coordination of supervision of the construction works was weak. The roles and responsibility must be better spelled out right from the start through the formation of a project task team. A standard implementation procedure is necessary.
- The WSB and WSP must work closely together during project preparation and implementation to enhance ownership (through a project task team)
- The WSP lacked capacity in project implementation and in operation and maintenance. There was a shortage in qualified personnel.
- The architectural design of the toilet building should be improved in terms of space use, efficiency, safety against vandalism (day/night) and user convenience. The WSTF has already developed an improved architectural design that will be implemented in Kenya from 2010 onwards
- The water consumption of conventional water flush toilets is very high (approx. 7-10 litres) and the cisterns regularly broke down due to misuse and/or vandalism. The experience often made in public toilets in Kenya is that the toilet cisterns fail to fill quickly enough (due to low pressure), so that users shift to pour flush system. This has a positive impact in terms of water conservation, but bears a higher risk of transmission of diseases if hand wash facilities are not working and not utilised by users.
- There is competition between the free (but unhygienic) council public toilets in walking distance from the bus park, or urination in the open, with the pay-per-use public toilet. Maybe the user fee should be lowered to attract more customers.

Fig. 13: Cistern after installation (left) and after vandalism/misuse and theft (right) a few weeks later. Repairs were undertaken by WSP, but the toilet operator now shifted to a pour flush system.

12 Sustainability assessment and long-term impacts

In Table 3 a basic assessment was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects were not emphasised (weaknesses).

Public toilet with biogas plant and water kiosk Naivasha, Kenya

Table 3: Qualitative indication of sustainability of the system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

	collection and transport			treatment			transport and reuse		
Sustainability criteria:	+	o	-	+	o	-	+	o	-
• health and hygiene	X				X			X	
• environmental and natural resources		X			X			X	
• technology and operation	X				X			X	
• finance and economics		X			X		X		
• socio-cultural and institutional	X			X			X		

Sustainability criteria for sanitation:

Health and hygiene include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, such as from fertiliser and the external impact on the economy.

Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see www.susana.org: the SuSanA Vision document "Towards more sustainable solutions"

With regards to long-term impacts of the project, the main expected impacts of the project are:

1. Demonstrate commercialisation of sanitation services within the institutional water sector.
2. Increased convenience for travellers and other clients.
3. Demonstrate that biogas can be produced from human excreta and used for cooking purposes.
4. Reduced organic load of the treated wastewater from this public sanitation facility discharged to the sewer (compared to the no-treatment option) and hence possibly a marginal improvement in final effluent from the wastewater treatment plant (monitoring of effluent quality is being undertaken, but data is not yet available).
5. A small contribution to improved public health (so far there are no plans to monitor the impact).
6. This was the first sanitation project of the WSTF. It served as a learning facility for various stakeholders and the improvement of facility design and implementation.

13 Available documents and references

The following documents are available:

Photos from this project are available on flickr:

- http://www.flickr.com/photos/gtzecosan/sets/72157623254082278/

Drawings:

- Drawings of biogas plant and public toilet (2007) http://www2.gtz.de/dokumente/oe44/ecosan/en-naivasha-drawing-ecosan-public-toilet-2007.pdf
- Drawings of new public toilet design (2009) http://www2.gtz.de/dokumente/oe44/ecosan/en-drawings-wstf-public-toilet-new-design-2009.pdf
- Drawings of fixed dome biogas plant for cow dung and agricultural waste (AKUT, 2007) http://www.susana.org/lang-en/cap-dev/visual-aids-drawings/technical-drawings

Publications:

- Poster on Naivasha, 5th World Water Forum in Istanbul, (GTZ, 2009) http://www2.gtz.de/dokumente/oe44/ecosan/en-poster-naivasha-worldwaterforum-wwf-istanbul-2009.pdf
- Public sanitation concept of WSTF (WSTF, 2009) http://www2.gtz.de/dokumente/oe44/ecosan/en-wstf-public-sanitation-concept-2009.pdf
- Public toilet management guideline of WSTF (WSTF, 2009) http://www2.gtz.de/dokumente/oe44/ecosan/en-wstf-public-toilet-management-guideline-2009.pdf
- Water and sewer tariffs from NAIVAWASS (NAIVAWASS, 2009) http://www2.gtz.de/dokumente/oe44/ecosan/en-naivawass-water-and-sewer-tariffs-june-2009.pdf
- Case Study: Water Kiosks (GTZ, 2009) http://www.gtz.de/en/dokumente/gtz2009-0193en-water-kiosks.pdf
- Flyer Water Kiosks http://www2.gtz.de/dokumente/oe44/ecosan/en-gtz-flyer-waterkiosk-2009.pdf

Video clips will be available soon on Youtube in the SuSanA account: http://www.youtube.com/user/susanavideos

The WSTF with the support of GTZ is providing design and management guidelines for water kiosks and water supply related infrastructure called “water supply toolkit” and for public sanitation called “sanitation toolkit”. These documents as well as additional documents on the project are available from the WSTF (as DVD).

14 Institutions, organisations and contact persons

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Case study of SuSanA projects

Public toilet with biogas plant and water kiosk Naivasha, Kenya

SuSanA 2010

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