



Fig. 1 Project location

### 1 General data

**Type of project:**

Demonstration facilities at rural primary schools as part of the larger Ecosan Promotion Project (EPP)

**Project period:**

Start of construction: August 2007  
End of construction: May 2010  
End of monitoring period: Nov 2010

**Project scale:**

70 schools with UDDTs (double vault system) - in most cases with 2 toilets for boys and 2 toilets for girls per school  
263 toilets in total and 8,000 children (approx.) served based on 30 students per toilet

**Address of project location:**

Lake Victoria region with Nyanza, Western and Rift Valley province; Eastern, North-Eastern and Central Provinces in Kenya

**Planning organisation:**

EU-SIDA-GTZ Ecosan Promotion Project (EPP), Kenya (embedded in the GTZ Water Sector Reform Program)

**Executing institution:**

- GTZ
- School administration and boards
- Various Water Services Boards
- Water Services Trust Fund (WSTF)

**Supporting agency:**

- European Union (EU): ACP EU Water Facility (60 %)
- Swedish International Development Agency (SIDA) (30 %)
- German Technical Corporation (GTZ) on behalf of German Federal Ministry for Economic Cooperation and Development (BMZ) (10 %)

Note: since 1 January 2011, GTZ is called GIZ, after the merger with DED and Inwent.

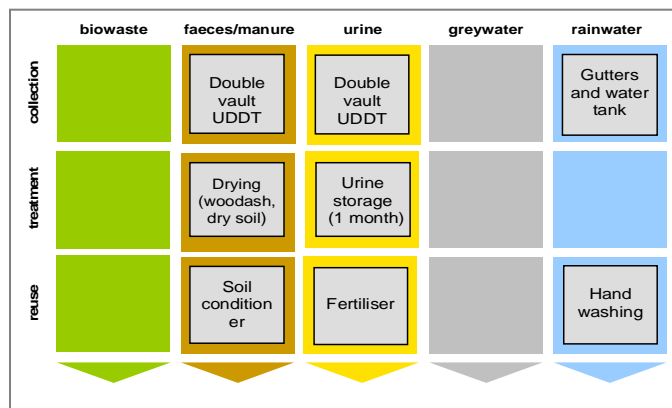


Fig. 2 Applied sanitation components in this project (UDDT stands for urine diversion dehydration toilet).

### 2 Objective and motivation of the project

The Ecosan Promotion Project (EPP) implemented a number of UDDTs in schools as part of the project. The focus on school sanitation in general had several long-term objectives:

- To improve the learning conditions of the students through improved sanitation facilities and accompanied hygiene education. The sanitation solutions had a focus on the reuse of human excreta as a resource. This concept is also known as ecological sanitation (ecosan).
- To engage a wider audience of schools and the surrounding households, so called clusters in order to support, stimulate and create demand for ecosan in the area.
- To engage the children as effective agents of change. Children pass on their knowledge of better hygiene practices and improved facilities from school to their parents and thus influence the communities.
- The toilets built under this program mainly served as an entry point for promotion and awareness raising only. The number built per school (usually four cubicles) was too few to have a real impact on the everyday life of the pupils.



Fig. 3 School UDDT block with two cubicles for boys with urinal on the right and hand washing station in the centre on top of the urine collection chamber at Mwala Primary School near Machakos (source: Johannes Orodí, GTZ-Kenya, Oct. 2009).

Ecological sanitation offers an alternative sanitation solution for many schools in Kenya as it has various advantages to conventional pit latrines and as it generates products that can be used as fertiliser to grow crops in school gardens and thus can improve food security or generate additional income.

The focus of this document is on urine diversion dehydration toilets (UDDTs) for schools implemented under the EPP. The EEP also built household UDDTs, biogas and DEWATS systems. For more information on the EPP see Rieck (2010c) and the blog of the Ecosan Kenya Network<sup>1</sup>. The project's aim was to develop, test and promote the reuse orientated sanitation concepts for large and small-scale applications in mostly rural areas of Kenya.

### 3 Location and conditions

In many schools in Kenya, basic sanitation and hand-washing facilities are not provided or are in a very poor condition. Schools are often unable to provide a healthy environment mostly due to the lack of political motivation and attention for sanitation and hygiene. This generally leads to<sup>2</sup>:

- Schools with inappropriate, poorly managed and insufficient sanitation facilities for children, especially for children with physical disabilities, girls and small children (under the age of eight years old).
- A lack of financial resources for cleaning and maintaining toilet facilities in schools.
- Lack of proper hand washing facilities (including water and soap) and anal cleansing material (such as toilet paper or water).
- Lack or poor enforcement of regulations and guidelines related to school sanitation and keeping the premises clean.
- Insufficient or non-existing budgets and financing for sanitation for new facilities and also operation and maintenance of existing facilities.



**Fig. 4** Old pit latrines at Muslim Primary School, Mumias in Western Province (source: Laura Kraft, GTZ, June 2010).

Girl students are especially affected by lack of facilities due to their special needs during menstruation. They fear to use

<sup>1</sup> <http://ecosankenya.blogspot.com/>

<sup>2</sup> See also SuSanA factsheet on school sanitation: <http://www.susana.org/lang-en/library/rm-susana-publications?view=ccbctypeitem&type=2&id=1188>

toilet facilities that are situated in an isolated location or mixed facilities for boys and girls due to the risk of harassment or rape<sup>3</sup>. For example more than 500,000 Kenyan girls stay at home during their menstrual cycle missing out on approx. 90 school days a year (Onyango et al., 2009). It is recommended to provide separate sanitation facilities for boys and girls and appropriate space for changing and washing of sanitary pads as that can help to keep girls in school more consistently and longer.



**Fig. 5** Newly finished block of two school UDDTs in Western Province. Old pit latrines are visible in the background (source: Moses Wakala, GTZ, April 2009).

Usually pit latrines are used in Kenyan schools which are often inappropriate due to risk of groundwater pollution and flooding. Flooding is a common problem during heavy rains and can cause the destruction of the toilets and also the flushing out of the human excreta into rivers, wells and other drinking water sources. This is often the cause for outbreaks of cholera and other water borne diseases. In some cases, schools have "grave yards" of old, filled pit latrines that cover large parts of the entire compound and will eventually limit digging of new pits.

Occasionally pits are lined on the side with masonry in areas with unstable soils or a conservancy tank is installed underneath the toilets, which are then emptied by a pump. The sludge is then often disposed unsafely in nearby ditches or water bodies if available.

Apart from the space limitation many schools face the challenge of rocky grounds, unstable soils and high groundwater levels that make the construction of pit latrines very expensive and hardly possible.

Most pilot projects were realised in rural primary schools located near the Lake Victoria in Nyanza and Western Province of Kenya. This part of Kenya is characterised by high population density, regular outbreaks of cholera and intensive agricultural activities. The sandy and loamy clay soils found around Lake Victoria are used for farming activities as the main source of income for the population. Generally, the greater Lake Victoria area is characterised by sufficient rainfall for agricultural production. The rainy period is April/May and October/November.

<sup>3</sup> African Population and Health Research Center (APHRC) <http://aphrc.org/download/?id=99>



A few toilets were also built in Rift Valley and Central province and the semi-desert areas of Eastern and North-Eastern (near Wajir).

In 2010, the under-five child mortality rate was at 85 children per 1000 in Kenya, and is has been decreasing during the last twenty years.<sup>4</sup>

#### 4 Project history

The Ecosan Promotion Project (EPP) was an EU-funded and SIDA and GTZ co-funded project embedded in the larger Water Sector Reform Program of GTZ in Kenya. The project started in November 2006 and ended in May 2010. Within the project period 263 double vault Urine Diversion Dehydrating Toilets (UDDTs) were constructed in 70 schools by the EPP and also a certain (still unknown) number of school UDDTs via the WSTF. More than 600 UDDTs were constructed in households (Rieck, C. 2010c) and flushed based systems with DEWATS and biogas systems were installed in various schools and public places (see map in Fig. 6).

The EPP has constructed UDDTs in 62 primary and 8 secondary schools in mostly rural areas of Kenya. The list and detailed maps of schools is found on the ecosan network Kenya blog<sup>5</sup>. Beginning from mid of 2007 the first toilets were constructed in schools. Main target areas were Nyanza and Western Province.

#### Partners

The EPP offices were located at the Ministry of Water and Irrigation in Nairobi who was the main local partner. In the beginning of the project in 2007 the project assigned three sanitation officers, so called regional site managers (see contacts in Section 14), who were coordinating the implementation work directly with the communities, community based organisations (CBOs), schools, local administration, NGOs and artisans.

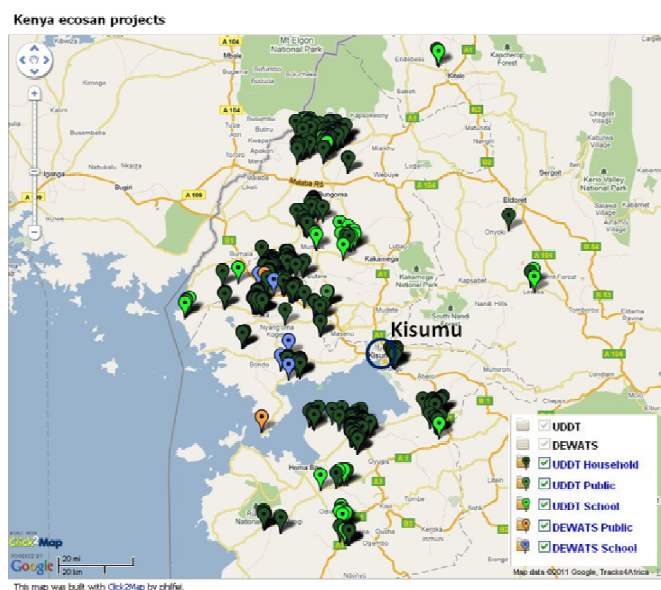
In schools the EPP worked with the school administration and parents-teachers associations. Initially also NGOs with experience in ecosan implementation were engaged to support the process and provide capacity building for the EPP sanitation officers. These NGOs were KWAHO (Kenyan Water for Health Organisation)<sup>6</sup> and ALDEF (Arid Land Development Focus). The local community based organisations (CBOs) were also involved in the school projects since at the same time household toilets were implemented in the surrounding community as part of the cluster approach (see below). Often the schools were also used for meetings and trainings of the community.

After initial contact with the school administration the project team usually received an official request for support. After agreeing to the terms, the school and EPP signed an MoA stating roles and responsibilities of each partner (see example of Memorandum of Agreement in Section 13). Generally the school contributed mainly by participation in trainings but rarely in material, cash or labour contributions. The "sanitation project cycle" and implementation program of WSTF give an

overview of the participatory process that was applied (Rieck, 2010).

Between 2007 and 2010 more than 30 local masons were trained in building the toilets and were later contracted by the EPP to carry out the construction process in the communities.

Beginning of 2010 also the Water Services Trust Fund (WSTF) in collaboration with the water sector institutions of the Water Services Boards (Lake Victoria South and North in Western und Nyanza Province, Athi in Central Province and Tana Water Services Boards in Eastern Province) started to implement UDDTs in clusters following the established approach. The EPP acted as a support organisation to the institutions in project preparation, implementation supervision and training activities.



**Fig. 6** View of Nyanza Province and Western Province (located in the South and North respectively) along Lake Victoria where most units were constructed. The light green markers mark UDDTs in schools.

#### Cluster approach

The approach was to always set up a cluster of 10 to 15 UDDTs at households and 4 at one local primary or secondary school. A walking distance of less than 20 minutes between these toilets was envisaged but not always achieved. The idea was to include both households and a school as they form one community. This should provide more momentum for sanitation improvements instead of focusing only on households or schools individually or by providing only one or two toilets per community. Ideally neighbours shall become encouraged to replicate the toilets as there are trained masons in the locality. However sufficient replication rates have not happened as monitoring suggests (see Section 11 on lessons learnt and Rieck (2010c) for more info).

Schools should also promote good hygiene behaviour to children who then can pass this on to their families at home. If there are also adequate sanitation facilities at the households of the children as well, the desired behaviour change from schools to households is more likely to happen. However due to the small number of provided UDDTs and low replication rates (see paragraph above) this effect was likely to be only minimal. 10-15 UDDTs would serve about 100-200 people in a community which consists in general of far more than 500 people.

<sup>4</sup> 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.childmortality.org> and <http://www.childinfo.org/>).

<sup>5</sup> <http://ecosankenya.blogspot.com/p/projects.html>

<sup>6</sup> [www.kwaho.org](http://www.kwaho.org)

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### 5 Technologies applied

Urine diversion dehydration toilets (UDDTs) with a double vault system were constructed, because it is a robust, safe and user friendly technology. In comparison single vault urine diversion toilets require regular emptying of vaults and handling of partly fresh faeces which less acceptable to users. Usually two separate “blocks” of toilets for boys and girls were constructed; one “block” consisted of two cubicles only (see Wakala 2008). Boys urinals were also implemented in less than 10 schools, since usually urinals exist in sufficient numbers in schools. However the lack of new urinals has led to negative effects (see Section 11).



**Fig. 7** Plastic urine diversion squatting pan with concrete footsteps inside a UDDT. Urine is collected in the centre; the two lids are covering the two faeces vaults (source: Laura Kraft, GTZ, June 2010).



**Fig. 8** Faeces vault of UDDT with ash-covered dried faeces (source: Laura Kraft, GTZ, June 2010).

The plastic squatting pan separately collects faeces and urine. The urine is collected in containers located in an attached urine collection chamber (see Fig. 3). The faecal matter drops straight into the vault, where it is stored for a period of approx. six months under conditions that are

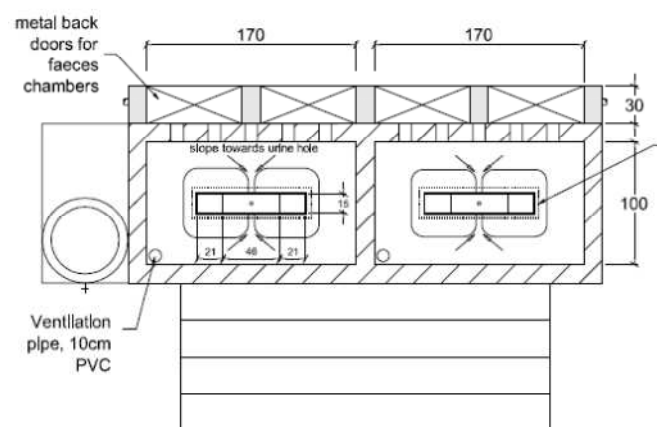
intended to promote drying and reduction of pathogens to a reasonable level for handling. When the first vault has been filled, the faecal waste is allowed to dry for the time which is required for the second vault to fill up (approximately six months). After each use, a scoop of ash is sprinkled over the faeces for improved drying, fly prevention, pH treatment (increase) and to cover the fresh faeces for aesthetic reasons.

### 6 Design information

Each school received 2 cubicles of UDDTs for boys and 2 cubicles for girls. In some cases also cubicles for teachers were constructed. Each cubicle will be shared by about 25 to 40 school children which depends on how the school is allocating the toilets to a certain group of classes or years. Therefore about 100 to 160 pupils were served per school.

Locally burnt bricks, concrete blocks or in some cases hydra-form blocks were used to build the masonry of the toilet structure. On the outside the masonry is keyed, on the inside plastered and painted in light colors. The toilet slab (floor) is made of cement, ballast, sand and twisted iron bars. For the storage of the faeces every toilet has two vaults that are connected to one vent pipe. The volume of the faeces chamber is 560 L with a length, width and height of 0.75 x 1.1 x 0.75 m.

About five steps are needed to reach the toilet door.



**Fig. 9** Top view of toilet block with 2 UDDT cubicles and hand washing unit (source: Rieck, GTZ, January 2010)

The vault doors are made of metal sheets fixed on a wooden frame, painted black and are placed in a steep angle (inclined) in order to enhance solar heating. It was later realized that vertical vault doors are a better option (see Rieck et al., 2011 and Section 11). Firstly many times the toilets are not properly aligned towards the sun for many practical reasons and end up predominantly shaded thus are not serving the original purpose of solar absorption. In addition inclined vault doors face challenges with increased risk of rainwater leakage, vandalism (people sitting on it, placing or storing objects) and additional construction costs and complexity as compared to vertical doors.

The squatting pan for urine diversion is manufactured by a Kenyan company called Kentainers (see section 14) and was designed in cooperation with the EEP. It is made from plastic and has two faeces holes with a lid on each hole for a double vault system. While one lid has a handle for the vault which is



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in use, the other lid is without a handle and has a weight tied underneath to cover the hole of the inactive faeces vault (but this was too confusing for children, see technical lessons learnt in section 11). Each toilet cubicle has one ash container with a scoop and a laminated instruction poster.

The diverted urine is collected in two 20 liters plastic containers which are filled alternately. A flexible hose pipe (size 1 inch) connects the squatting pan's urine outlet with the container. The containers are stored in an attached urine collection chamber on which a 100 liter plastic water tank with a tap is placed for the purpose of hand washing. Soap is suppose to be provided by the school and usually placed next to the tank (see Fig. 1). The roof of the facility has a rainwater catchment system which directs rainwater into the water tank. In case there is not sufficient water available, the tank can be manually refilled with water from other water sources. The hand washing system is suboptimal as it provides no privacy (more infos in technical lessons learnt in Section 11).



**Fig. 10** Rear view of 2 toilet blocks with inclined vault doors and ventilation opening which also provide additional light inside the cubicle (source: Paul Mboya, GTZ Kenya, Jan 2009)

The toilet design did not consider in detail issues of menstrual hygiene management. However sanitary bins were provided in each cubicle for the girls block.

Note: Design shortages are described in section 11.

### 7 Type and level of reuse

The students, teacher and partly staff of the schools were trained on how to use the UDDTs and the excreta products properly and safely (see Fig. 11 Fig. 12). The urine is used after a short storage time in the containers as a fertiliser either on school gardens that are used for agricultural experiments of students or larger school farms if available. Not all schools did however venture into reuse and instead do dispose the urine at trees and bushes. For reuse the urine is diluted at a rate of 1:1 up to 1:5 before use in the school gardens. The gardener digs a small shallow trench next to the plant, pours the urine into the trench and covers the trench immediately with soil, so that nitrogen evaporation is minimised. Additionally the students and teachers were instructed that the last urine application should be at least four weeks before harvest.

The crops which have been fertilised with the urine in school gardens include kales, spinach, maize, mangos and bananas.



**Fig. 11** Two 20 L urine containers with flexible hoses in a vault attached to the UDDT at Mwala Primary School, Ukambani (source: Johannes Orodi, GTZ Kenya, Oct. 2009).

The dried faeces are used directly on the school farms as soil conditioner after the second vault is full (approx. six months). No further treatment is applied but the users are advised to use the faecal matter for planting fruit trees like bananas and mangos and burying it. The school is strongly advised in trainings to apply health risk reduction measures like wearing gloves, rubber boots and washing hands with soap.

In terms of reuse of urine and faecal matter the follow up visits by consultants working for GIZ in mid 2010 showed mixed results (see Section 11). The majority of the schools do use the fertiliser for demonstration purposes but not food production. Often the school farms are small and not well managed, and the urine is mostly applied to trees or dumped on the ground. Certainly the lack of adequate and well timed training in reuse at the point of need resulted in these mixed results.

### 8 Further project components

#### Trainings and establishment of health clubs

In many Kenyan schools the project team observed that hygiene education is practically non-existent. Therefore all students, teachers and the parents were asked to participate in trainings with the main objective being to create awareness on sustainable operation and maintenance of school toilets and the link between sanitation, hygiene and health.

Furthermore in all schools a health or ecosan club was established or engaged if it already existed. The aim was to ensure a progressive, active and vibrant body of students who would mentor new members on the operation and maintenance of the UDDTs, the reuse of urine and dry faeces and the dissemination of information on ecosan and hygienic behavior.

Many students joined the clubs because they felt appreciated and had trust in the ecosan project. The schools usually provided a dedicated teacher as a patron to guide and oversee the clubs which usually had 20 to 40 members. The clubs were encouraged to network with other pilot ecosan

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schools in the same area in order to learn from one another. The effectiveness of clubs was not monitored, however a few problems were observed (see Section 11).

It was observed after the trainings that increasing knowledge on ecosan led to increased use and appreciation of facilities.



**Fig. 12** Awareness creation and training in Mwala Primary School near Machakos in Eastern Province (source: Paul Mboya, GTZ Kenya, Oct. 2009).

### 9 Costs and economics

The investment costs per double vault UDDT with one cubicle are about KSH 50,000 (approx. EUR 500) as shown in Table 1. The school toilets of this case study usually had two cubicles (= one toilet “block”), see Fig. 3. The capital costs were thus about EUR 1000 for one toilet “block”. Most schools obtained two toilet blocks, therefore the cost per school was EUR 2000 for hardware. The operation and maintenance costs are low as the school itself collects the products from the toilet and uses it directly in their farms.

**Table 1** Cost breakdown for one cubicle of double vault UDDT (Blume, 2009). One toilet block with 2 cubicles costs about double.

Item category	Costs in Ksh	Costs in Euro
Foundation	4,525	45
Double vaults incl. doors	6,250	63
Toilet slab	3,789	38
Squatting plate (plastic)	3,500	35
Urine chamber with slab for water tank	3,900	39
Urine chamber doors	3,000	30
Ventilation	630	6
Steps	1,425	14
Walls with burned bricks	7,579	76
Doors	1,800	18
Painting	1,000	10
Roofing	3,268	33
Hand washing unit	800	8
Rainwater Harvesting	745	7
skilled labour costs	7,000	70
unskilled labour costs	3,000	30
<b>Total</b>	<b>52,211</b>	<b>522</b>

However the UDDTs can be made cheaper by using different materials, avoiding painting and other simplifications like omitting the rainwater harvesting system. See the study on costs and economics of UDDTs by Blume (2009).

Ideally, the contribution by the schools should be at least 20% of the total construction costs to ensure ownership. However in most cases the schools were not able or not sufficiently convinced to organise contributions from their own budget, the parents or the community.

The design used here is quite expensive making it hardly affordable for wide scale replications without state funding. The most significant cost items were cement and stones. The UDDTs were not built in the cheapest way but rather with high quality and appealing character making it a rather “fancy toilet” with high construction costs. It was the idea of the EPP team to market the UDDTs as modern and uplifting which in turn should create a positive mindset on development and instill pride. This approach has however not translated into broad replication of this technology in schools due to other underrated factors like high costs and donor dependency.

### 10 Operation and maintenance

As mentioned above, operation and maintenance of the UDDTs is done by the school itself, often the health or ecosan clubs (i.e. the students) but also by employed school staff (but not the teachers). It is not clear how the clubs created substantial incentives to students to clean the toilets (e.g. recognition, peer pressure, rules in the school etc.)

The club members and their patron participated in a special training on the use of urine as fertiliser and faeces as soil conditioner (operation). The club was provided with protection items and sanitary bins as well as T-shirts and base caps for individual members as incentive and motivation to participate as shown in

Fig. 13 .



**Fig. 13** Health club members with protection items like gloves, mask, rubber boots and equipment like watering cans as well as sanitary bins that are given to the school and managed by the club, Mwala Primary School, Eastern Province (source: Paul Mboya, GTZ-Kenya, Oct. 2009).

The maintenance activities of the UDDTs includes cleaning, provision of wood ash, checking for blockages of the urine pipes, emptying full urine containers (every day) and full faeces vaults (every 6 months). It also includes minor repairs

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of the water tap (hand washing unit), chamber doors (due to rusting, termites), roofing, rainwater harvesting and occasional repainting.

### 11 Practical experience and lessons learnt

The major challenge in implementing sanitation facilities in schools is to create sustainable operation and maintenance systems within the school. This strongly relates to the level of ownership. Since the participation, financial and material contribution of the schools and surrounding community was very low in most cases, the ownership did not sufficiently develop. This has brought challenges to the cleaning and management of the toilets.

Due to challenges during planning and construction, some toilets were not yet finished when the trainings took place. The impact of the training without having the new toilets tends to be low as knowledge gets lost without application.

Furthermore many toilets started operation shortly before the end of the EPP project time in May 2010. Therefore the required trainings on reuse of urine and faeces could not take place. For the use of dry faeces it takes one year to "harvest" (filling half year and resting half year) thus many schools did not reach that stage during the time of EPP. Moreover simple operational problems like blocked urine pipes occurred only later when no direct support from GTZ was available anymore.

After the end of the EPP project the GTZ sustainable sanitation program in Germany funded some basic follow up visits of 45 schools with UDDTs and 12 schools with decentralised waste water treatment systems (DEWATS) including trainings and technical support until Nov. of 2010. The findings of these follow-up visits were crucial to compile the lessons learnt in this section. Due to funding constraints, it was unfortunately not possible to visit all the schools where UDDTs had been built or to do a thorough quantitative analysis of all the problems.

#### General observations

- A generally high workload of teachers, overcrowded classrooms (high pupil/teacher ratios) and underpaid teachers indirectly affected the interest and motivation of teachers to engage in additional initiatives such as overseeing health or ecosan clubs.
- Since each school received only 4 toilets and school size ranges from 200 to sometimes 1,000 students not all students were allowed or able to use the new toilets. This resulted in overcrowding of the toilets which quickly led to dirty toilets and misuse.
- Misuse was also a problem, such as dumping of ash or even faeces in urine section. This led to blocking of the urine pipes and odour problems.
- The school management obviously did not manage or was not willing to unblock the urine pipes since this was an unexpected problem and an offensive (smelly) business. Sadly, the local artisans were not contacted by the schools for assistance even though they could have easily provided this service. It must be assumed that many or most of these schools were not able or willing to provide financial resources to maintain "donor-funded" toilets.
- Another big challenge was to enforce hand washing with soap after the toilet use. Most of the rainwater tanks could not be used properly as they were either stolen, not filled

with water or damaged. Soap was usually not provided by the schools. Even after trainings with the aim of creating awareness on proper hygiene behaviors there was generally a lack of interest and finance (budget) for operation and maintenance of hand washing.

- In some cases the success of a project also depended on just one or two committed school directors and teachers. Once they left the schools the UDDTs quickly got misused and neglected resulting in closure of the facilities. This often happened once the urine pipe got blocked.

**Software and project design lessons learnt** (most of these aspects were not done so well in this project and are thus important learnings which we want to share)

- Awareness creation and participation of all parents and other community members in the implementation process for school toilets is most important to make sure that UDDTs and reuse are accepted and well understood within the community. Contributions of parents and community members to the construction of the school toilets and the use of state funds in order to limit donor money dependency are important. This will build the crucial ownership needed for proper operation and maintenance
- Training of local artisans on entrepreneurship that goes beyond construction alone is important, for example issues of operation and maintenance of the toilets so that they can provide support services to the schools. This would be a possibility for income generation, if the school agrees to sign a service contract e.g. services for emptying and management of excreta, reuse of fertiliser in agriculture etc.
- Always provide a sufficient number of toilets with the same standards for all students and teachers. Demonstration toilets seem to not lead to the replication of more toilets in schools. The Kenyan standard (Ministry of Education) requires a ratio of 1 toilet per 25 female students and 1 per 30 male students. Other standards call e.g. for a ratio of 1/50 for boys if urinals are provided. Also female urinals – used in a squatting position - should be installed as it provides more hygienic conditions for girls and would mean that fewer toilets would need to be constructed and maintained.
- Build more affordable designs which are more likely to be replicated by schools for the cases that schools grow in students numbers and for the replacement of old facilities. Adapt local designs used for the school buildings and households.
- Provide a sufficient follow up and monitoring process over a time period of at least two years after the start of use that ensures trainings at all crucial stages after the start of operation (i.e. for unblocking of urine pipes, application of urine, closing of full vaults after 6 months, handling of dry faeces after another 6 months, repairs of vault doors, doors, water taps etc.).
- Make sure the school has a sufficient budget and available resources for toilet paper, soap and O&M activities such as replacement of water taps that will enable continuous hygienic practices and proper use of sanitation facilities.



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**Fig. 14** A urine pipe of a urine diversion squatting pans got blocked with ash at Muslim Primary School, Mumias. Faeces drop holes are covered with lids on the left and right in this photo (source: Laura Kraft, GTZ, June 2010).

- Make use of urine a simple activity or use soil infiltration (e.g. soak pit, infiltration trench) to fertilise trees instead of manual application which will lower work load.
- Ensure a continuous training and learning process at the schools on proper use and maintenance of the toilets. A good way might be to introduce specific hygiene curricula in the schools, use school competitions (award schemes) and other tools to motivate learning and keep engagement up.
- Making sure that menstrual hygiene management issues are included in design, implementation and trainings.

**Technical design lessons learnt:**

- No specific provision was made for menstrual hygiene management at the schools, except the allocation of sanitary bins. The project was not aware that teenage girls often use old cloth during menstruation as pads which need to be washed for the purpose of reuse. Hence girls might miss school when they are menstruating due to the fact that there was no space or water provided to change and wash their sanitary towels in privacy. However this could be done over the urine section of the squatting pan provided that the urine is not reused. Otherwise a separate drainage should be provided inside the toilet.
- In only a few schools the boy's UDDTs had urinals. Boys then often used the toilets for urinating instead of going to the existing old urinals, which led to splashing and urine entering the faeces vaults, since boys naturally stand during urination. This causes bad smell and unhygienic conditions.
- The system with two lids on the squatting pan confused some children in such a way that some students defecated into the urine section or tried to open the closed (resting) vault forcefully for defecation. Hence it is recommended to only cover the faeces hole of the resting vault and leave the "active" vault's hole uncovered (the children are used to one open hole in pit latrines).
- There were also problems with leakages of rainwater into the faeces vaults due to poor craftsmanship and insufficient material quality of the vault doors (e.g. untreated wood frame of the vault door was consumed by

termites). In order to address this problem of rainwater leakage it was decided for future installation to use only straight vault doors with minimal risk of rainwater leakage and which is also cheaper and simpler in construction.

- The flexible hose pipes of 1 inch for urine collection have blocked very often due to accidental use of ash in the urine section, faeces and other obstructive materials. Many times the flexible pipe also developed sharp bends if bended too tightly e.g. in corners that can easily lead to blockages. Therefore it is recommended to use a bigger diameter of 2 or 3 inch and preferably standard PVC pipes. The school toilets should be retrofitted. The choice of flexible hose pipes was made on basis of similar designs worldwide, however these challenges were not documented prominently.
- The 20 liter urine containers are too small thus causing heavy work load due to frequent exchange of containers. It would be better to provide 2 big alternating tanks that allow for treatment (short term storage) and bridging of times with no need for fertilisation
- The plastic tank of the hand washing facility needs to be secured in a concrete ring to avoid theft. The tank can be permanently fixed. It was often witnessed that the tanks were missing or used for other purposes.
- The design with steps does not take into account pupils with disabilities etc., therefore sitting types like bench design should be considered (see Rieck et al., 2011)

## 12 Sustainability assessment and long-term impacts

A basic assessment (Table 2) 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).

**Table 2** 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).

Sustainability criteria	collection and transport			treatment			transport and reuse		
	+	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	

With regards to long term impacts of the project, the main expected impacts were (note: these impacts have not been verified yet):

- Students spread their knowledge about ecosan within their families and communities which results in a higher demand and awareness of improved sanitation.



## Urine diversion dehydration toilets for rural schools Nyanza, Western and other provinces, Kenya

- Higher awareness on proper hygiene practices like hand washing amongst the students.
- Reduction of investment cost for sanitation hardware do to longer life spans of UDDTs as compared to pit latrines
- Increased agricultural production of school farms through use of fertiliser from UDDTs. schools

### 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 the SuSanA Vision document "Towards more sustainable solutions" ([www.susana.org](http://www.susana.org)).

### 13 Available documents and references

Regular updates about the project sites are given on the Ecosan Kenya Network Blog: <http://ecosankenya.blogspot.com/>. More communication is available on the Kenya Ecosan Network facebook page: <http://www.facebook.com/ecosan.kenya>.

**Photos** from this project are available on flickr:

- School UDDTs in Kenya  
[www.flickr.com/photos/gtzecosan/sets/72157628127018213/](http://www.flickr.com/photos/gtzecosan/sets/72157628127018213/) and other sets in the Kenya collection

### Videos:

- Promoting ecological sanitation in Kenya (01/2010)  
<http://susana.org/lang-en/videos-and-photos/resource-material-video?view=ccbktpeitem&type=3&id=8>
- Johannes Orod Odhiambo explains the advantages of UDDTs at a new toilet in Ugunja (05/2009)  
<http://susana.org/lang-en/videos-and-photos/resource-material-video?view=ccbktpeitem&type=3&id=15>

### Drawings:

- Drawings and BOQ of urine diversion dehydration toilet for households and schools (Kenya), April 2010  
<http://www.susana.org/lang-en/library/rm-technical-drawings>

### Publications:

- Blume, S. (2009) Cost optimization of single door UDDTs in Kenya. GIZ Kenya, Nairobi, Kenya <http://susana.org/lang-en/library?view=ccbktpeitem&type=2&id=513>
- Blume, S. and Rieck, C. (2010) Singing the Gospel of Ecosan – A Kenyan Toilet Preaching  
<http://ecosankenya.blogspot.com/2010/06/sing-ing-gospel-of-ecosan-k-enyan.html>

GTZ and SIDA (2007) Using the EcoSan toilet,  
<http://susana.org/lang-en/library/rm-posters?view=ccbktpeitem&type=2&id=352>

Kraft, L. (2010) Final sampling report for products from double-vault UDDTs (faeces and urine), GIZ Eschborn, Germany  
<http://susana.org/lang-en/library?view=ccbktpeitem&type=2&id=1026>

Odhiambo, J.O. (2008) Example of a Memorandum of Agreement, GTZ-Kenya  
[http://www.susana.org/docs\\_ccbk/susana\\_download/2-129-2-1354-en-memorandum-of-agreement-2009.pdf](http://www.susana.org/docs_ccbk/susana_download/2-129-2-1354-en-memorandum-of-agreement-2009.pdf)

MWI (2009) The Water Sector Sanitation Concept – WSSC, Ministry of Water and Irrigation (MWI) Kenya  
[http://www.susana.org/docs\\_ccbk/susana\\_download/2-129-2-1355-en-mwi-kenya-sanitation-concept-2009.pdf](http://www.susana.org/docs_ccbk/susana_download/2-129-2-1355-en-mwi-kenya-sanitation-concept-2009.pdf)

Onyango, P., Odhiambo, J.O. and Oduor, A. (2010) Technical Guide to EcoSan Promotion, GTZ-Kenya  
<http://susana.org/lang-en/library?view=ccbktpeitem&type=2&id=710>

Rieck, C. (2010a) Sanitation project cycle for rural areas, Kenya  
[http://www.susana.org/docs\\_ccbk/susana\\_download/2-129-2-812-kenya-project-cycle-uddtoilets-epp-wstf-wsb-20101.pdf](http://www.susana.org/docs_ccbk/susana_download/2-129-2-812-kenya-project-cycle-uddtoilets-epp-wstf-wsb-20101.pdf)

Rieck, C. (2010b) Implementation programme of EPP/WSTF/WSB  
[http://www.susana.org/docs\\_ccbk/susana\\_download/2-129-2-813-kenya-implementation-programme-uddtoilets-epp-wstf-wsb-2010.pdf](http://www.susana.org/docs_ccbk/susana_download/2-129-2-813-kenya-implementation-programme-uddtoilets-epp-wstf-wsb-2010.pdf)

Rieck, C. (2010c) UDDTs implemented via CBOs and Water Services Trust Fund, Nyanza, Western and other provinces, Kenya, GTZ Kenya, Nairobi, Kenya,  
<http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=129>

Rieck, C., von Münch, E. (2011). Technology review of urine diversion dehydration toilets (UDDTs) - Design principles, urine and faeces management (draft). (GIZ), Germany.  
<http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=874>

Wakala, M. (2008) Construction work of two institutional UDDTs, household toilets and ferro-cement water tank – Butere Mumias <http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=1193>

### 14 Institutions, organisations and contact persons

#### Technical Planning and Implementing Support

EPP (EU-SIDA-GTZ Ecosan Promotion Project), Kenya (during Nov. 2007 to May 2010); Ministry of Water and Irrigation (MWI), Maji House, Ngong Road, Nairobi, Kenya  
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**Partner organisation:**

Ministry of Water and Irrigation, Nairobi, Kenya  
Contact: Eng. Ombogo, E: [patrick\\_ombogo@yahoo.com](mailto:patrick_ombogo@yahoo.com)  
Contact: Rose Ngure, E: [ngure\\_rose@yahoo.com](mailto:ngure_rose@yahoo.com)

**Executing organisation:**

Primary and secondary schools  
<http://ecosankenya.blogspot.com/p/projects.html>  
KWAHO (NGO) <http://www.kwaho.org/>  
ALDEF (NGO) [aldef@nbnet.co.ke](mailto:aldef@nbnet.co.ke)  
Various Community Based Organisations (CBOs) and private construction companies (e.g. Comila in Kisumu) and masons

**Executing institutions:**

Lake Victoria South Water Services Board, Kisumu  
(<http://www.lvswaterboard.com/>)  
Lake Victoria North Water Services Board, Kagamega  
(<http://www.lvnwsb.go.ke/>)  
Athi Water Services Board  
(<http://www.awsboard.go.ke/>)  
Tanathi Water Services Board  
(<http://www.tanathi.go.ke/>)

**Financing agencies:**

Water Services Trust Fund (WSTF)  
Engineer Mr. Macharia  
Han Seur  
P.O. Box 49699 – 00100, Nairobi, Kenya  
Email: [macharia@wstfkenya.org](mailto:macharia@wstfkenya.org)  
Email: [hanseur@hotmail.com](mailto:hanseur@hotmail.com)  
Web: [www.wstfkenya.org](http://www.wstfkenya.org)  
T: +254 20 713020

**Supplier of sanitary ware:**

aquasantec (Kentainers Kenya)  
Embakasi Office, Off Airport North Rd, Nairobi, Kenya.  
T: +254 20 2519098/99 E: [info@aquasantec.com](mailto:info@aquasantec.com)  
Contact: Paul Madoc, E: [paul\\_madoc@kentainers.com](mailto:paul_madoc@kentainers.com)  
Web: <http://www.kentainers.com/kent/kentainers.html>

Case study of SuSanA projects

*Urine diversion dehydration toilets for rural schools  
Nyanza, Western and other provinces, Kenya*

SuSanA 2011

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