Case study of sustainable sanitation projects

Otji-Toilets for peri-urban informal households Omaruru, Namibia

Fig. 1: Project location.

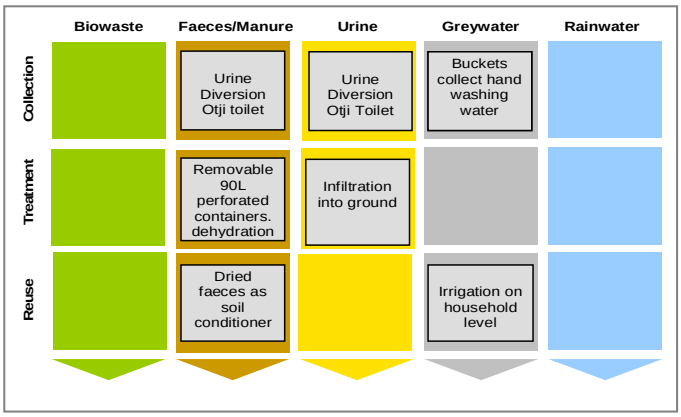

Fig. 2: Applied sanitation components in this project, Otji-Toilets work like UDDTs

1 General data

Type of project:
Pilot scale urine diversion dehydration toilets for peri-urban informal households

Project period:
Construction period: Dec. 2010
Start of operation: Dec. 2010

Project scale:
Number of dry toilets: 21
Number of inhabitants covered: approx. 140
Total investment: EUR 17,000

Address of Project Location:
Hakahana, Omrauru, Namibia

Planning institution:
Namibian Water Resource Management – Deutsche Gesellschaft für International Zusammenarbeit (GIZ)
Wilhelm Zeraua Rd, Old Rossing Foundation Building, Omaruru, Namibia

Executing institution:
Namibian Water Resource Management – Deutsche Gesellschaft für International Zusammenarbeit (GIZ) & Omaruru Basin Management Committee (OmBmc)

Support institutions:
German Federal Ministry of of Economic Cooperation and Development (BMZ)

2 Objective and motivation of the project

As Namibia is the driest country in southern Africa, a national toilet system sustained by fresh water is not sustainable in the long run. To provide access to safe, affordable sanitation for all Namibians, it is essential to consider dry sanitation as proactive measure to water shortages and as a way to save precious water resources in the wake of climate change. Not only do dry toilets save water and thus facilitate drought adaptation strategies; ideally, they also produce fertiliser to sustain crops and can thus effectively eliminate the need to dispose of human waste via a centralized sewage system.

Against this background, the Omaruru Basin Management Committee decided to pilot 21 Otji-toilets in Omaruru (Fig.3). People living in the project area have no access to safe sanitation. Especially, for women and children, the traditional way of “going to the bush” is dangerous. During the rainy seasons, water related health problems such as diarrhoea are increasing. The project was planned as a pilot study to show that dehydration toilets with urine infiltration are an appropriate sanitation solution for the informal settlements of Omaruru, Namibia.

Fig. 3: Otji-toilet with attached hand washing basin (source: GIZ, Kleemann, 2011)

The name Otji-Toilet is only used in Namibia, where it has been introduced as a product name. Moreover the name is well-known in Namibia. Technically speaking it is a urine diversion dehydration toilet (UDDT).

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3 Location and conditions

Omaruru lies about 200km northwest of Namibia's capital city Windhoek, on an altitude of 1200m above sea level, in the Erongo region. The climate in the area is arid with a yearly precipitation of 280mm in average (Omaruru municipality, 2010). The depth of ground water table in the Omaruru basin varies, two borehole measurements in the area reflected a depth of 2.46 metres and 3.40 metres respectively[1].

Omaruru has about 12,000 inhabitants. The population lives spatially separated in the town of Omaruru (2,000 inhabitants), and the partly informal settlements of Hakahana (6,000 inhabitants) and Ozondje (4,000 inhabitants). The project area is located on the edge of Hakahana and can be describes as informal and peri-urban.

Many people live in self built shacks made from scrap metal and wood, some buildings are also made from bricks. Drinking water is provided through taps. Depending on the location of their house, people have to walk up to 300m to get water. Sanitation facilities are not available in this area. For the people living in the town, sanitation is provided through septic tanks, suction trucks and oxidation ponds.

Farming and tourism are the main economic factors in Omaruru. Due to the Omaruru river the water level is quite high and vegetation is relatively dense. About 30% of the population are unemployed (Omaruru municipality, 2010). Socio-cultural conditions are diverse. Most of the white population, from different origin live in the town. The majority of the black population consider themselves as Ovambo. Beside that, mostly Herero and Damara people live in Omaruru.

In 2009 the under-five child mortality rate was 48 children per 1000 in Namibia, and is has been decreasing during the last twenty years[2].

4 Project history

The need for proper sanitation was raised at one of the Omaruru Basin Management Committee (OmBMC) Meetings in the beginning of 2010. Members of the OmBMC travelled to the Clay House Project (CHP) in Otjiwarongo, a town 100km from Omaruru, to learn about the construction of dry toilets and to have a look at examples in town which were already built and in use.

The Clay House Project (CHP) is a non-governmental organisation, based in Otjiwarongo in Namibia. Its overall aim is to promote environmental and socially sustainable development. The European Community is currently funding this project which aims to promote the building of 600 Otji-Toilets in Otjiwarongo and all over Namibia. The funding started in February 2008 and runs to the end of 2011.

During this exposure trip GIZ gave a presentation on different sanitation options and discussed with the members the most feasible options. The Otji toilet which were first developed in 2003 in Namibia and have had approximately 1200 installations[3] across Namibia was the example shown in the exposure visit.

The selection of the pilot project area and beneficiaries was based on a rapid baseline survey including a demand assessment as well as a movie show of the toilet system conducted by the OmBMC in cooperation with GIZ. In the area water is limited and has to be carried up to 300m from taps. There are no sewers and no cesspools in the area which could be used for flush toilets. Beneficiaries were selected on a "first pay first served" basis and in coordination with the ongoing formalisation process of the Omaruru Municipality.

The pilot project construction of 21 toilets was finalised by the end of 2010. Since then, the toilets were maintained by the owners. An awareness campaign for a period of one week was conducted to further promote the toilets and to highlight the importance of washing hands after using the toilets. After the dry toilets have been in use for about 3 month GIZ and the OmBMC carried out a small survey in order to assess the satisfaction among toilet users. All users were happy to have a toilet!

At the moment 21 toilets, which were built during the pilot project, are used in Omaruru. The OmBMC has evidence for a demand of additional 100 toilets. Until now, however, funds for additional toilets have not been approved from the Municipality and the Regional Council.

Future

The future of the applied sanitation system in Omaruru is highly dependent on the political decisions made. It turned out, that although the system proved to be appropriate, there is still a tendency towards water based sanitation systems. A major challenge will therefore be, to persuade and consult the responsible decision makers. Apart from that, the OmBMC will further raise awareness also among farmers and in the tourism sector.

Depending on the further development of the project in Hakahana a strategy for the reuse of the sanitation products will be developed. Persons were identified, which would be willing to empty the toilets. GIZ is considering possible public private partnership (PPP) strategies[4]. The objective is to support a local business in establishing a production scheme of the otji-toilets in the area.

[1] In the Omaruru Basin at borehole ww40139 – under the bridge in the riverbed the average depth is 2.46m and at borehole ww40144-east of Omaruru in the riverbed the average depth is 3.40m.

[2] 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/).

[3] Since the development of the Otji-Toilet in 2003 about 1.200 Otji-Toilets have been installed nationwide across Namibia as well about 100 self builder sets have been sold. The breakdown of where the 1200 Otji-Toilets were installed is as follows; 600 for an EU-Toilet-Programme; 83 for an EU housing programme; the Municipality Otjiwarongo bought 100 in connection with the development of Erven where the CHP have built clay houses. The Municipality paid for the toilets which where built inside the houses (solar ventilated inside the toilets). The Municipality of Outjo bought 200 and Aranos bought 40 Self-Builder-Sets. The Oshikoto Region bought 49 Otji-Toilets and the City of Windhoek 57. Other customers included NGOs (for example: the Desert Research Foundation of Namibia (DRFN)), Farmers and Safari Lodges (for staff and camp sites). In future the CHP is going to be promoting more the Self-Builder-Set so as to encourage local builders to create a job opportunity for themselves.

[4] One PPP that was being investigated at the time of writing this case study was with Pupkewitz, see their website for more details http://www.pupkewitz.com/

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5 Technologies applied

The Otji-toilet is based on dehydration and was considered especially suitable for a region with intense solar radiation and low precipitation.

The functional plan (Fig. 5) shows the main features of the Otji-toilet. The ventilation and dehydration is driven by the sun. Therefore, the “back” of the toilet is always oriented strictly north (southern hemisphere). Air then circulates through the toilet into the drying area and out through the ventilation pipe, which makes the toilet odourless. The collecting bucket (90 liter container) is situated under the toilet bowl and moved to the drying area when full. The bucket with the dried faeces is emptied and moved beneath the toilet bowl. It is estimated, that four people can use one container for about 6 month.

The toilet bowl is designed in such a way, that fluids touching the wall of the bowl are collected in a small chute and can be drained away through a pipe and separately infiltrates it into the ground (Fig. 4). No problems of blockages of the collection chute or the urine pipe, which is 20mm in diameter, have been reported.

Fig. 4: Cross section of urine diversion bowl (left) where urine collects in the little trough at the bottom as demonstrated in urine diversion bowl (right) (source: CHP, 2009)

However the urine could also be collected in containers and stored for reuse. The faeces are collected in a 90 litre container which is perforated. Faeces and paper stay in the container, whereas liquid infiltrates into the ground. Thereby, dehydration is more effective. Some users have indicated that they use ash to cover the faeces after defecation, but this is not widely practiced at the moment. As the pilot project finished only about four month ago, no containers had to be emptied until now.

There is a potential for reuse as many of the toilet owners or their neighbours have a small garden on their compound. However, not all of them can imagine using urine or dried faeces as a fertiliser. The oxidation ponds of the Municipality are not far away and could be used to properly dispose material, which cannot be reused.

The toilets were built by teams of members of the CHP in Otjiwarongo and locally available labour from Omaruru. Except for the brick construction, the toilets were prefabricated in Otjiwarongo and delivered as “self building sets”. The team of the CHP was important to ensure the proper construction of the toilets and to train local labour for possible future projects. In some cases, the beneficiaries contributed to the construction of the toilet (digging, painting).

There are no rights reserved on the technology, in figure 5, of the Otji-Toilet nor on the name. However the Urine Diversion System (UDS)-Bowl is a registered patent in South Africa and Namibia. The UDS-bowl was developed at the end of 2008. Since the beginning of 2009 a number of propotypes have been in use at the Clay House Project compound in Otjiwarongo, Namibia. Since 2010 about 100 units have been installed at different places nationwide in Namibia. The most are installations are in Windhoek with 57 units.

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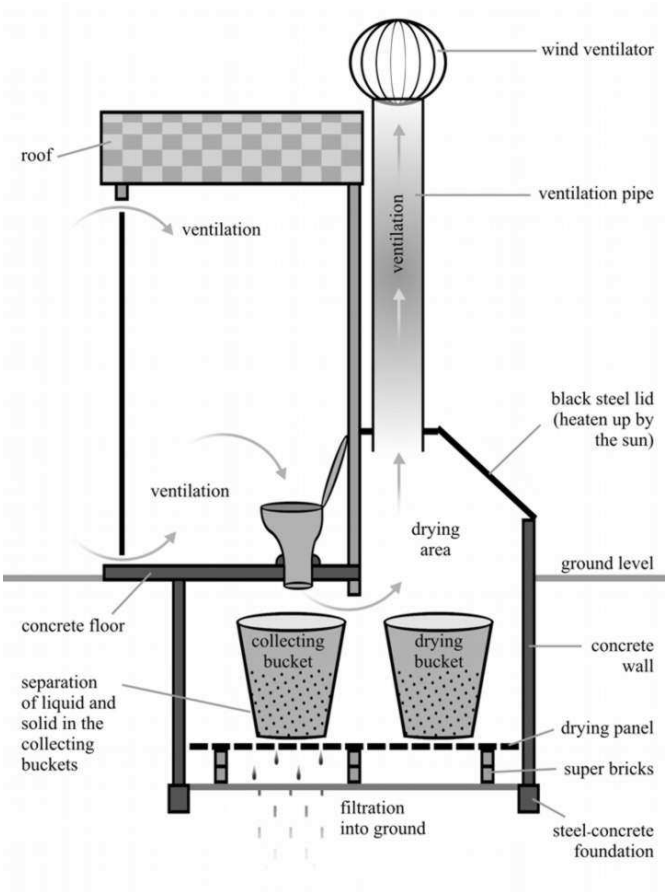

Fig. 5: Functional plan of the Otji-toilet without urine diversion bowl (source: CHP, 2009)

6 Design information

Basic design parameters

The project was initiated, following the urgent need of sanitation facilities in the poor areas of the informal settlements of Omaruru. Furthermore, the project was designed to show the advantages of dry sanitation systems, especially, in arid regions such as Namibia. The aim of the project was also to involve the local authorities in such a way, that they can implement sanitation facilities in the future based on the findings of the pilot study.

Assumptions

The Otji-toilet was considered an appropriate solution for the project area. As water supply and other relevant infrastructure is limited, dry sanitation was favoured. Furthermore, water saving was considered crucial when designing new sanitation facilities.

Applied design and construction method

As experience in the design and construction was available from the CHP, there were no changes required. The prefabrication in at the CHP is based on empowerment of

local communities and low technology. Toilets are designed to work with a minimum of maintenance. Except for the toilet bowl, all toilet parts are made in Otjiwarongo. Once the toilets are built no further investments are necessary as the emptying can be done by household members or locally available labour.

Construction material used
As mentioned above the toilets were partly prefabricated by the CHP. The most important parts were made from metal (lid box, door, doorframe, roof structure, ventilation pipe, steel foundation ring) and concrete (dry plates, floor plates, side plates for lid box). Apart from that, the toilet bowl was delivered through the CHP and material such as screws, nuts silicon and wire were used. For the toilet house, bricks, cement and sand were used. The roof tiles were also fabricated by the CHP and designed to keep the toilet cool compared to the drying chamber.

Further information, including the self building manual of the CHP are available under: http://home.arcor.de/clayhouse/

7 Type and level of reuse

The level of reuse of this project is yet to be demonstrated, as the system has not been in use for long.

However, there are certain design parameters of the toilet which indicate the focus on providing save sanitation rather than reusing its products. In the following, reuse possibilities are outlined.

Urine
The toilets currently used in Omaruru all infiltrate the urine into the ground. It remains unused.

However, urine can be easily collected through the urine diversion bowl and an attached container at the end of the pipe. Then it can be used as fertiliser. Therefore, awareness raising among the population and trainings are necessary.

Faeces
The dried faeces can be used as soil amendment or can be co-composted with other biodegradable material. On a small scale the material can easily be used on the compound of the households. Some of the users can imagine using the material, others are reluctant. Again, awareness raising among the population and trainings are necessary.

Greywater
Water from the attached handwashing facilities is collected and used for irrigating gardens. Most people use the greywater on their compound and often is directly applied to water plants..

8 Further project components

In addition to the construction of the toilets basic handwashing facilities were attached (Fig. 6) to the toilets with a handwashing instruction. To raise awareness among the population a dry-toilet and handwashing campaign was initiated.

Fig. 6: Basic handwashing facilities attached to the toilets. The pink bucket provides fresh water, the cup is used to fill the basin and the black bucket collects the greywater which can be used for irrigation (source: GIZ, Kleemann, 2011).

The GIZ and the OmBMC are currently trying to upscale the project. There is demand for about 100 additional toilets.

To make the project financially sustainable the funding for additional toilets should come from the Municipality of Omaruru or Namibian Ministries as a general service provision. Additionally, GIZ works on a concept to support the application for funds from the national government.

As already mentioned, the establishment of a PPP is planned within the GIZ resulting in a local producer for otji-toilets and lower prices for the toilet.

A relaunch of the awareness raising campaign on dry toilets and sanitation is planned, as well as trainings on reuse.

9 Costs and economics

One Otji-toilet costs about EUR 776, which makes it an unaffordable commodity for the people living in the target area. Costs for the toilets of the pilot project were covered by the German Federal Ministry of Economic Cooperation and Development (BMZ). Beneficiaries contributed a minor part of EUR 15 to the toilet. The contribution served as a “registration fee” and was important to create a feeling of ownership to secure that people look after the toilets and maintain them well.

Operation and Maintenance costs are very low. Once the construction is finished, the toilet can be used. With four people using one toilet, it takes about six month for the 90l container to fill up. After the first year of operation, the container with the dried out faecal matter has to be emptied every six moth depending on the number of people using the toilet. If a toilet needs to be emptied twice a year.

Obviously the transport costs are dependent on the distance from the place where the toilets are currently prefabricated (in this case Otjiwarongo, about 140km).

Table 1: Costs for the material, labour and transport needed to construct a Otji-toilet (source: CHP, 2009).

Cost break-down:	Price in EUR
Lid box	61
ventilation pipe	27
door	56
door frame	20
steel roof structure	28
foundation steel ring	20
roof tiles (cool tiles)	9
urine separation toilet bowl	60
pipes and fittings	15
perforated 90l container	45
side plates	20
dry plates 70 x 70	15
floor plate	14
silicon, wire, etc.	5
superbricks	96
cement bag	24
Sand m^3	10
paint l	29
Total materials costs	**554**
Estimated labor and transport Costs	**222**
Total Costs	**776**

Because the toilets are custom-made by the CHP and many parts are especially produced for the toilets, it was not possible to compare with market prices. With the establishment of a local producer through a PPP, it might, however, be possible to lower the prices.

10 Operation and maintenance

When investigating the toilets three month after the construction, all of them were in use and well maintained. Most owners also lock their toilets when they are not around. Until now no maintenance, was necessary, except for regular cleaning of the toilet bowl, as none of the containers were full. Some toilet users indicated that they will empty their toilet on their own and use the material on their compound as fertiliser or bury it. As there are only a few toilets existing until now, it seems reasonable to engage one or two persons willing and able to undertake the emptying.

One possibility for the Municipality to meet its obligation of providing general service to the people would be to instruct someone within the Municipality to collect the material and bring it either to the nearby oxidation ponds or the local dumpsite or to supply it to a local gardener.

Another possibility would be to contract someone who is familiar with the operation and maintenance of the toilets to collect the material. This person would need to be able to transport the material whenever necessary. Ideally, a second person would be available to step in. For transport a pickup car would be ideal. Because the number of toilets is yet relatively low, also a wheelbarrow or a donkey cart could serve the purpose for the beginning. It is important to brief the contracted person of where to dump the material.

The payment for the emptying could be established informally but should in the long run be covered by the municipality and financed through waste collection fees or water charges. If toilet owners would charge for the use of their toilets, emptying cost could also be covered. On a household level that seems not likely as many people do not want other people to use “their” toilet. For small pubs (“shebeens”), however, that could be a good solution

11 Practical experience and lessons learnt

The Otji-toilet is an appropriate technology for the conditions of the project area. It is independent from other infrastructure and can be built almost everywhere.

From a financial point of view, the contribution of the beneficiaries seems very low. However, to reach the poorest among the population, there is the need of highly subsides will facilities, as they will not save money to get a toilet in the first place. In the future, the toilets should be built with local money as part of the general service for the inhabitants of a settlement.

The acceptance of the toilets is high, which is not surprising, as people who were without sanitation facilities now have one, and appreciate it. There are also many of the users who are especially happy to have a dry system, as they do not have to pay for water.

The small scale of the project makes it difficult to establish a reuse scheme other than the use on household level.
A main issue is the difficulty to persuade decision makers of the appropriateness of the system. There are many people who still favour water based sanitation. Also some users are keen to have a flush toilet. It is important to remember, however, that many people cannot afford water for the toilets. Without the support of decision makers it will not be possible to establish a dry sanitation system on a large scale. As the price level in Namibia is quite high the toilets are not affordable for the poor.

The pilot project was, however, very important to persuade some decision makers and people of the appropriateness of the technology.

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 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" (www.susana.org).

With regards to long-term impacts of the project, the main expected impact of the project is to provide relevant information for decision makers and to persuade them about the necessity of saving water by introducing appropriate sanitation systems. Furthermore, improved public health and safety, especially for women and children are key aspects of the project.

13 Available documents and references

More photos:
http://www.flickr.com/photos/gtzecosan/sets/72157626328329107/

CHP – Clay House Project (2009): Dry toilet systems, http://home.arcor.de/clayhouse/

CHP – Youtube Video: http://www.youtube.com/watch?v=mRXFSAdImgA

CHP – Clay House Project (2009): The Otji-Toilet: self builder manual, http://susana.org/lang-en/library?view=ccbktypeitem&type=2&id=916

CHP – Clay House Project (2009): The Otji-Toilet, http://susana.org/lang-en/library?view=ccbktypeitem&type=2&id=915

Omaruru Municipality (2009): Omaruru Town Profile.

14 Institutions, organisations and contact persons

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SuSanA 2011

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