CUVEwaters integrated water resources management

Selected Results from Socio-Ecological Participatory Situation Assessments in Two Sites in Central Northern Namibia

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1 Introduction

CuveWaters is a research-based project aimed at improving people's living conditions and livelihoods by introducing alternative water technologies and practices in the Cuvelai-Etosha Basin as part of a process towards Integrated Water Resources Management (IWRM). The project's main objective is to foster a multi-resources mix and water re-use by identifying and implementing the most appropriate technologies for water and sanitation in use and management. These technologies should link water use with other aspects such as use of rangelands, agriculture, wastewater management and pollution control. Potential transfer and introduction of technologies is to be done with full stakeholder and specifically community participation. The project area is situated in Cuvelai-Iishana sub-basin in the Oshana region (Figure 1), one of four sub-basins of the Namibian part of the Cuvelai-Etosha Basin.

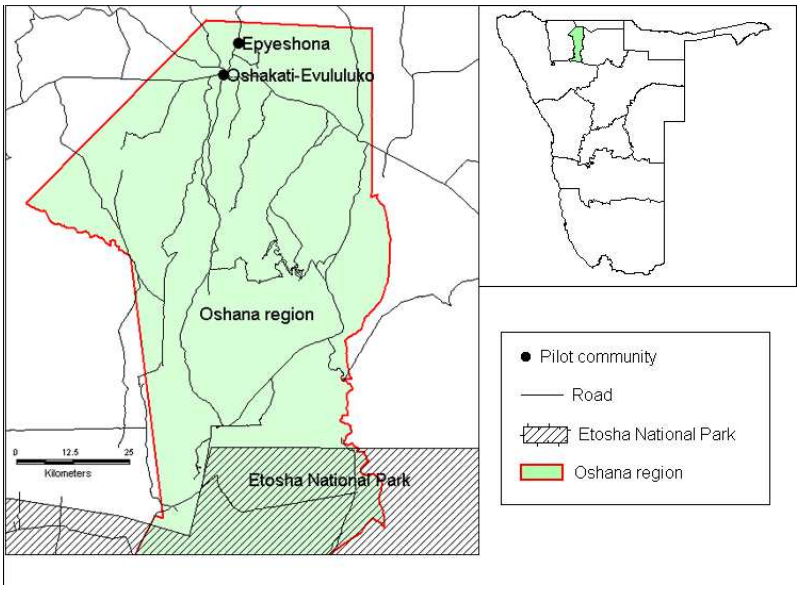

Figure 1. Location of the study area in the Cuvelai-Iishana sub-basin in the Oshana region (Source: DRFN)

To achieve the project goals, an understanding and knowledge about living circumstances, water use patterns as well as the preferences and attitudes of the water users are essential. In this context attention should be paid to intercultural differences (between water users and research team) in perceptions, behaviour and attitudes toward technology options. New technologies will only be introduced if they meet technical and cultural needs of the users in the project area.

CuveWaters is funded by the German Federal Ministry of Education and Research (BMBF) and is implemented through a research cooperation that comprises three German institutes: Institute for Social-Ecological Research (ISOE), Technical University Darmstadt IWAR (Chair of Water Supply and Groundwater Protection) and Fraunhofer Institute for Interfacial Engineering and Biotechnology (IGB). In Namibia, CuveWaters cooperates closely with the Ministry of Agriculture, Water and Forestry (MAWF), the Desert Research Foundation of Namibia (DRFN), the Federal Institute for Geosciences and Natural Resources (BGR) and the German Technical Development Cooperation (GTZ).

In this report selected results from two series of participatory workshops[1] with residents in the project region are presented. The main focus is on results concerning the new technology options introduced. Other results have been documented in project-internal reports on the empirical work.[2] Results from the CuveWaters Stakeholder Workshop, held in Oshakati in October 2007, are integrated where they elaborate on results gained from the participatory workshops with urban and rural residents.

2 Method

The first situation assessment was conducted by facilitators from the DRFN and ISOE to assess peoples' perceptions of living conditions in urban Evululuko and rural Epyeshona with a focus on water and sanitation use and management. The assessment took place over three days at each site in May 2007, using several participatory tools developed by the research team. A second situation assessment was conducted in August 2007 by the same institutes, accompanied by IWAR (rural site: rainwater harvesting) and IGB (urban site: sanitation). The second assessment was done with almost the same community representatives that took part in the first assessment.

The tasks of the empirical study were:

- to integrate information gathered on an individual level concerning living conditions, water supply, water use and sanitation, costs, opinions and perceptions of the existing situation;
- to follow a participatory approach to evaluate and assess these patterns and techniques, and to identify problems;
- to use a participatory process for developing possible future options and assessing their acceptance together with urban or rural inhabitants.

Therefore, the CuveWaters team developed an empirical method which combined both: qualitative social-empirical methods to gather information and to understand the inhabitants' behaviour and attitudes, and methods of participatory assessment to encourage participation concerning problem identification and opinions about new developments. The CuveWaters team is aware of the long-standing focus on national development in this highly populated area since Namibia's independence and on the experiences of the population in dealing with potential development initiatives.

Participants of the situation assessments held in Evululuko and Epyeshona were:

- Members of the Community Development Committee (CDC) of Evululuko and some other invited residents as representatives of Evululuko community, in total around 20 participants;
- Residents of Epyeshona village being members of the Water Point Association, the Water Point Committee or the Local Water Committee, in total around 30 participants;

The group constellations gave a fair reflection of the gender and age distributions in the two communities. As there was chosen a qualitative empirical design, the composition of the group does not have to be representative in a statistical understanding. The group members were typical community members referring to their household constellation etc. giving their opinions

1 In the following also entitled as empirical workshop or assessments.
2 The reports can be ordered on request at the general editor.

mainly as private individuals and not necessarily in their role as community stakeholder representing the opinion of others.

The situation assessment reports (CuveWaters Project 2007 a-e) have significant bearing on the piloting and implementation of the technology options proposed to the inhabitants of the two pilot communities. This integrated report is augmented by the results of the CuveWaters Stakeholder Workshop that was held in October 2007 to take the outcomes of the four situation assessments and the follow-up technology analyses forward. Results of various meetings and discussions with national, regional and local government officials as well as NGOs and private sector people involved in water supply and sanitation in Namibia are also included in this report.

3 Study areas and technology options

Evululuko, an informal settlement in Oshakati east constituency, was chosen to assess the potential for introducing alternative water supply and sanitation technologies and the interest of local people in urban gardening. Epyeshona, a village in Okatana constituency was selected for assessment of the potential of rainwater harvesting. During the course of the project alternative technologies have been identified, e.g. groundwater desalination and artificial groundwater recharge. These technology options have not yet been subject of empirical workshops with the local communities, but they were presented, thoroughly discussed and criteria for their evaluation identified at the CuveWaters Stakeholder Workshop held in October 2007.

3.1 Urban site: Evululuko

Evululuko is an informal settlement in the south-western part of the city of Oshakati. It is the home of about 4.800 residents (Urban Dynamics 2001: 134 pp.). Evululuko is a fast growing settlement. However, there are still empty plots in the middle and at the edges of the settlement. Especially towards the south it is mostly comprised of informal settlements. Only one tarred road and a few gravel roads service the area. There is water reticulation in the area that is still expanding, but there are no sewer pipes. Evululuko is currently involved in a formalisation process, whereby land is being surveyed and title deeds are being issued to residents.

Technology option: community unit for sanitation

In Evululuko, sanitation is one of the most important and pressing issues for the inhabitants. As a consequence, the development of a community unit for sanitation (Figure 2) has been identified as a possible suggestion for further improvement by the CuveWaters team. Depending on size and layout of the community unit between 50 and 500 people can use a number of toilets, showers and other washing facilities for dish-washing and laundry. The basic principle of the community unit is that users of the facility will pay for the services. The revenue will cover the costs of water consumed, general maintenance and management of the centre. To save water, the application of vacuum toilets is being considered, as they only need about one litre of water to flush, compared to 3-10 litres for ordinary flush toilets. The flat terrain in Evululuko also makes the construction of a vacuum sewer system more favourable than a normal, gravity based sewer system as it implies e.g. reduced construction costs for excavation works of the sewer

grid. The wastewater is intended to be collected at a de-central wastewater treatment plant located in Evululuko settlement.

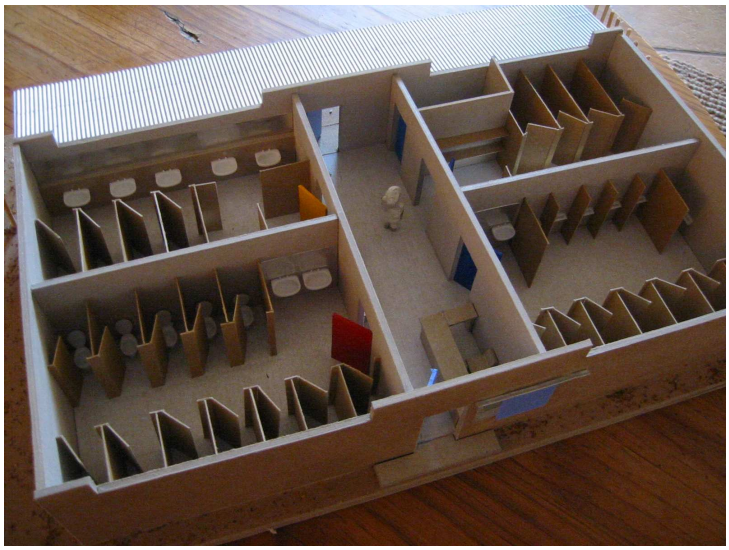

Figure 2: Model of community unit for sanitation (Source: CuveWaters)

For the waste water treatment an anaerobic process is under consideration, as this produces biogas, which can be used for cooking and lighting. Furthermore, the nutrients stay in the effluent of the plant, making the recycled water valuable for irrigation and fertilisation. To prevent people from getting sick by using the recycled water, a hygienically harmless effluent is required, which can be achieved by micro-filtration of the water. The treated wastewater is intended to be re-used by the inhabitants of Evululuko to water and grow vegetables for the local market or personal consumption. The production of vegetables could contribute to the local food safety and poverty reduction, as most vegetables for sale in the area are imported from South Africa.

Another technology under investigation is the harvesting of rainwater. For the piloting phase rainwater harvesting will primarily be introduced at the community unit. Rainwater collected from roofs can provide water with a very low salt content and high purity. This water can be used to flush toilets, for washing, or can be added to the irrigation water for urban gardening to prevent salinisation and over-fertilisation.

3.2 Rural site: Epyeshona

Epyeshona is a village located approximately 10 kilometres north of Oshakati in Okatana constituency. About 80 households belong to the village. Assuming an average household size of 8 people there could be about 640 residents in the village.

The village has three communal water points approximately 500 m from one another. Water at these water points is available to all inhabitants in Epyeshona, everyone has to pay for the amount of water used on a monthly basis. The maximum distance to walk, according to residents, is approximately one kilometre.[3] During the last three years about 80 per cent of the households in the village were able to afford private taps at their homesteads.

[3] This is close compared to many other rural areas in Namibia.

Technology option: Rainwater harvesting

Two small-scale rainwater harvesting catchment systems are suggested by the CuveWaters project as conceivable technical options for improved access to water: a roof catchment system (Figure 3) for human consumption as well as a ground catchment system (Figure 4) for livestock consumption, small-scale irrigation and to some extent human consumption. From a technical point of view, every rainwater catchment system consists of four basic components: a catchment surface for collecting the rainwater (roof or ground surface), a delivery system for transporting rainwater from the catchment to the storage tank (gutters or surface drains), the storage tank itself (various types of surface and sub-surface tanks) and an outlet tap (surface) or a simple pump (sub-surface) to withdraw water from the storage tank. Most homesteads in Epyeshona possess at least one corrugated iron roof. Well-constructed corrugated iron roofs with high run-off coefficients provide ideal catchment surfaces for rainwater harvesting. The numerous thatched roofs in the village cannot be used for rainwater collection, since they have a very poor run-off coefficient and discolour the water and make it less palatable and attractive for human consumption (Gould/Nissen-Petersen 2003).

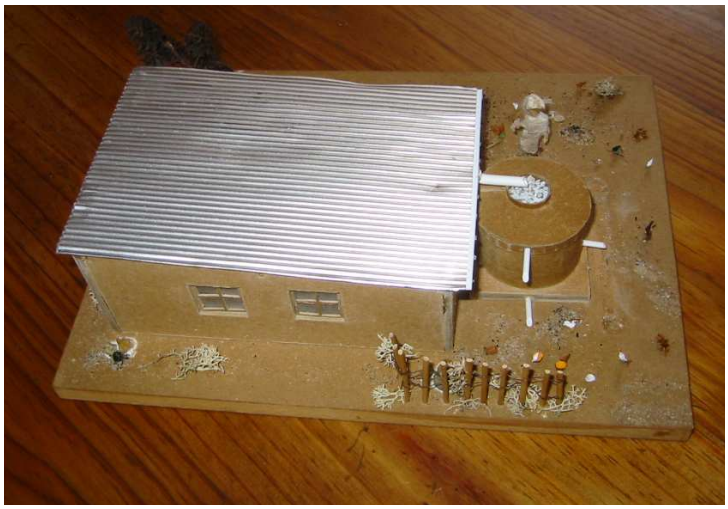

Figure 3: Model of roof catchment (Source: CuveWaters)

Ground catchment systems use natural treated or covered ground surfaces as catchment areas. They are normally constructed where suitable roof surfaces are not available. The main advantage of ground catchments compared to roof catchments is that the rainwater can be collected from a larger area, which is particularly advantageous in areas of low rainfall. On the other hand, the water can easily become contaminated, which restricts human consumption or makes treatment processes, e.g. boiling or chlorination, necessary. Since the water can only be stored below the surface it is generally less convenient to withdraw it for use. Furthermore, sub-surface tanks must have a robust cover to prevent children or animals from falling into them (Prinz 1996).

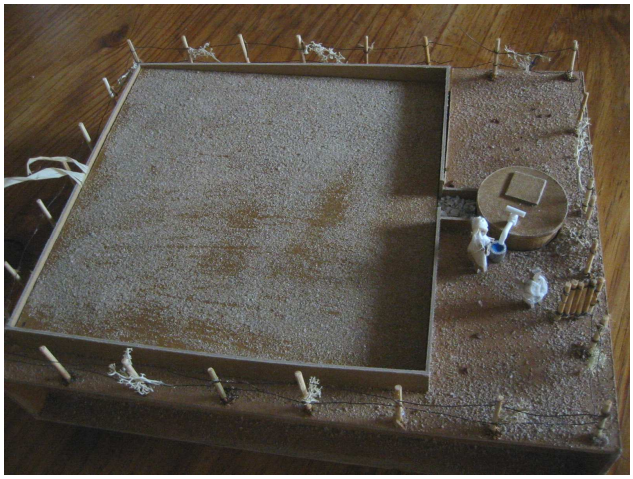

Figure 4: Model of ground catchment (Source: CuveWaters)

4 Main topics discussed in relation to technology options

The results of the first two situation analyses conducted in Evululuko (Figure 5) and Epyeshona (Figure 6) were manifold. Community representatives were all interested in piloting the technologies introduced to them by the CuveWaters team. Most participants of the workshops expressed their willingness to help with construction of infrastructure by volunteering or could identify people to be trained in the tasks required for the construction. However, their enthusiasm was hampered by concerns over cost of water. This relates partially to the debts the communities have incurred for non-payment of water. Other discussions related to the design of the infrastructure itself, the institutional arrangements that would be necessary to maintain the infrastructure and the potential livelihood enterprises that would be promoted by the developments identified. The following section was compiled with the intention of highlighting the concerns of the communities so that positive solutions to these concerns can be found. When reading the following discussion, the enthusiasm of the workshop participants must be kept in mind. Identifying solutions to issues raised by the community representatives will be the challenge of the community members, the municipality and other involved persons and institutions working together with the project implementers.

Figure 5: Workshop in Evululuko (Source: CuveWaters)

The results from the workshops held in the two pilot communities show that both communities are keen on the proposed technologies. Community representatives also participated and contributed in a frank and motivated atmosphere during the workshops.

Their enthusiasm offers great potential to overcome issues that could potentially impact negatively on the implementation of the project like payment for water, some local perceptions of proposed infrastructure, institutional arrangements and expected outputs of the suggested technologies. These issues are elaborated in the following chapter.

Figure 6: Workshop in Epyeshona (Source: CuveWaters)

4.1 Results from the urban assessments – community unit and waste water treatment

4.1.1 Costs

Based on the findings of the assessment conducted at the urban site by the CuveWaters team, one of the major factors determining if people will use purified water is how much the water costs. The cost of water services in Oshakati is regulated by a step tariff of NamWater (in Namibian Dollars per m³): 0–6 m^3 N$ 7.25; 6–15 m^3 N$ 8.36; 15–40 m^3 N$ 11.15; >40 m^3 N$13.94. The common perception among workshop participants is that the current cost of purified water is too high.

Most of the residents in Evululuko are unemployed or underemployed, which is said to have contributed to the closure of many communal water points in Evululuko due to non-payment. As a result many private taps are used jointly by several neighbours or households of relatives. This often results in even more unfair or non-transparent water costs. Consequently, people instead walk long distances to collect water at other sources of free but unpurified water.

This suggests that there is a need for awareness rising and social marketing with regard to water payment and hygiene. To introduce and possibly change the views on water costs it would be necessary to communicate how the added benefits of the suggested technologies can contribute to the needs expressed by participants of the assessments, such as privacy, health, safety, and shorter distances.

Although the topic cost of water supply was raised at the CuveWaters Stakeholder Workshop held in October 2007, it did not receive the prominence afforded to it during the situation analy-

ses. An explanation may be that the Stakeholder Workshop also involved government representatives and others who are aware of the relative cost of water and its key role in development.

Community unit

The concept of the community unit is based on a building that offers several services such as showers, toilets, laundry places, and washing basins for 50 to 500 people. The community unit is expected to be used by people living within a certain radius of the Centre, a distance yet to be established. The services may have to be paid for according to the current government cost-recovery policy.

It is important to note that in the case of a community unit there would be additional costs beside the cost of water used for various services that it may offer such as showering, flushing toilets and laundry. There would also be costs related to energy use for lighting and heating of water, cleaning materials, and payment of staff members who would operate and manage the centre as well as those who would guard and protect it from criminals or vandals. These additional costs have to be considered as serious determinants on the use or non-use of the community unit.

The concept of the community unit itself received intensive scrutiny at the CuveWaters Stakeholder Workshop. Cultural acceptability, safety and affordability were some of the issues raised. The following opinions were expressed: everyone must have private water-borne sanitation facilities; the community unit resembles pre-Independence facilities and thus would be unacceptable; private pit-latrines are preferable to shared facilities no matter how much privacy could be afforded. These issues differed in emphasis and relative prominence although not in content from discussions held with community representatives during the situation analyses. Nevertheless it can be stated, that the community members understood the concept as a step towards an improvement of the current situation.

Distance from households

The distance that people can walk to the community unit depends on the type of service and its cost. If only the type of services is considered, disregarding costs involved, results from the situation analysis show that people can walk relatively long distances (~1 km) for services which are not necessarily needed daily such as laundry and taking a shower, whereas for services such as the use of toilets, people would not be willing to walk a long distance. Walking long distances becomes even less feasible at night due to security reasons. However, it seems that if a service has a cost involved and is affordable it should be located as close to the household as possible. For toilets, the optimal location would be inside/at a private house, but this would induce high investment costs. From the first assessment it was clear that safe and hygienic types of sanitation facilities are not available for many inhabitants, even if there are several VIP or pit latrines visible in Evululuko.

However, as mentioned in the case of water collection from free sources, people seem to disregard the distance they can or have to walk to a site where the service they need is available for free.

Use of alternative free water sources

The extensive use of alternative, free, sources of water was identified during the empirical assessment. These sources are those where water is collected for free, without monetary cost. The residents of Evululuko commonly make use of two excavated earth dams and the canal that brings raw water from Calueque Dam into the NamWater purification plant in Oshakati (although this was challenged by local authorities at the Stakeholders Workshop). Water from these sources is unpurified and most probably not fit for human consumption. But there are people who use it for their entire household needs, including drinking. Certainly unpurified water is used for laundry and body hygiene. People are prepared to and indeed do walk long distances to these sources. In fact, the distance to the canal is not only longer than the distance to communal taps of purified water, which are within Evululuko location, but it is also located outside the boundary of Evululuko. This indicates that where a water source is available and its water is for free, people will make use of that water almost irrespective of its quality.

Generating additional funds

It is clear that the representatives from Evululuko are interested in having a community unit in their location. However, there is great concern about how to make its use and operation sustainable. Participants of the second community meeting held in Evululuko suggested that additional services such as renting office space in the community unit could generate funds to make the Centre affordable and hence improve the use of the services. Income from sale of biogas was debated at the CuveWaters Stakeholder Workshop. It was suggested that funds generated this way could be used to pay the salaries of staff members and probably the cost of energy. Some participants (of the community workshop) claimed that the funds generated could even subsidise the cost of services provided by the community unit.

4.1.2 Perceptions about infrastructure design

Residents emphasised the importance of, as far as possible, using materials and equipment that is available in Namibia and preferably in Oshakati. This was echoed strongly at the CuveWaters Stakeholder Workshop. The design of a community unit not only has to consider the actual services to be provided, but also has to consider the security and individual needs of the vulnerable groups of the community, especially women. According to residents in Evululuko, the current sanitation situation for women is inadequate in terms of safety and privacy. Therefore it was proposed by the residents that all services at the community unit should be separated to allow each gender their privacy, including the place for laundry. The design of the building and interior equipment has to respect privacy, visual protection and should offer the possibility to be controlled, in order to prevent criminal activities from being perpetrated at the community unit.

In the view of the participants the number of showers needed in the community unit also depends on gender. Residents assumed that more men than women are expected to make use of showers as women were said to be shyer than men. Therefore, the participants said the number of showers for men has to be more than those for women. On the other hand the participants concluded at another time, that women have a stronger need of being hygienic, which makes them bath more often than men. However, for the first pilot, the number of showers constructed should be the same. A study of the actual usage of the pilot facility will guide future construction.

A community unit also has to be protected from vandals and thieves. This according to residents can be partially achieved by having razor fences, which would hinder access of vandals to the centre except through the gate where there would have to be a security guard.

4.1.3 Institutional arrangements

Training

Residents expressed the desire to be trained in the construction or production of building materials such as bricks to be used to construct the community unit. Similarly, the importance of training and capacity building of residents was a key criteria identified at the Stakeholder Workshop for evaluation of the technologies provided by the project. The institutional arrangements of the community unit have to ensure that selected residents are trained in the maintenance and repair of the equipment of the community unit. This is to enable quick fixing of broken equipment without having to wait for a technician to come from far away places such as Windhoek or even Germany.

Residents have indicated that they would be willing to offer their labour that may be required to construct the proposed facilities. The offer of their labour was mentioned but it is not clear whether it is at a cost, low cost or voluntarily. In conclusion, the willingness to contribute manpower and to be trained has to be taken as evidence of the enthusiasm the community feels about the proposed developments. Furthermore, people have to be involved in the project from the beginning to give them ownership of the process and make them feel responsible for the operation and maintenance of the Centre.

Staffing and management

Another important issue regarding the functioning of a community unit is the management. Management of the centre involves maintenance and cleaning of the centre and collection of payments from users. The issue of payment is linked to the monitoring of how much water each user is using for each service, which would determine how much a user should pay. To exemplify this issue one can imagine a user who comes to the community unit and first uses a hand-washing basin to wash his hands, then brushes his teeth. The same user proceeds to use the toilet and then takes a shower and then comes to wash his handkerchief at a hand-washing basin before filling up his water container to take some water home. The user would have to pay for all the water used for each of the activities above. Therefore measurement of usage is a challenge that will have to be addressed for proper operation and cost recovery of such a facility.

Regarding staffing, residents proposed that there should be:

- A security guard who controls the access via the main gate of the community unit.
- Cleaners: in the view of the participants there should be at least two cleaners, one for each gender side.
- A trained caretaker is necessary who not only receives payments but also is trained to maintain and repair most parts of the facilities in the community unit. Several caretakers should be trained to cater for relocation of trained people.

4.1.4 Outputs and benefits of the waste water treatment

Recycled water

Residents were interested in using recycled water from the waste water treatment plant, and expect that this water will be significantly cheaper than purified tap water. When discussing how much the recycled water would cost, it is important to keep in mind that users already have paid for the water once while making use of the services at the community unit. Therefore some people are still under the impression that this recycled water will be for free, omitting the added costs of treating the water at the wastewater plant so that it can be used again.

Gardens

In Evululuko there were few gardens visible at the time of the assessment, which was undertaken during the dry season. However, according to residents, many people in Evululuko do prepare and plant vegetables during the rain season. When the rain season ends, free water for plants becomes scarce, and residents have to use tap water.

In Evululuko there was a community garden for a short while in the 1990's. Now this area is left unused even though there is water provided. Residents gave several reasons for the failure of the garden: the cost of water was higher than the income gained from sale of crops from the garden; pests infested the crops that affected the yield negatively; the soil is unsuitable for gardening; no agricultural inputs such as fertilisers were applied when the garden was in operation.

These issues suggest that further investigations are required to determine under which conditions and in which institutional framework house gardens, allotment gardens or a commercial garden can be established, making use of the recycled (fertilized) water being produced by the decentralised wastewater treatment plant to be implemented by CuveWaters.

Biogas

According to residents, no biogas is sold or produced in the area. However, most residents make use of butane gas for cooking and lighting. The gas is purchased from retail shops in the area. Residents showed interest in the production of biogas with the expectation that it will be cheaper than the price they currently pay for butane, since they will be contributing some of the inputs for its production. In the current status of planning the community unit, not knowing how many people will use the centre and what for, it is unclear how much biogas will be produced and whether the quantities produced will be economically feasible.

4.2 Results from the rural assessments – rainwater harvesting

4.2.1 Costs

Although the cost of water (N$5.48/$m^3$ from a communal tap and N$10.50/$m^3$ from a private tap) at Epyeshona is lower than in the urban site Evululuko, it is still regarded to be high and thus perceived as expensive by the residents in Epyeshona. Nevertheless, 80 per cent of households currently have private taps for domestic use. Moreover, it was clear from the situation analyses and particularly the CuveWaters Stakeholder Workshop that access to inexpensive water for livestock is the key issue for residents although often not clearly articulated in discussions.

The residents' use of other sources of water, such as rainwater, is very restricted, due to inadequate collecting and storing methods. The proposed options of rainwater harvesting aim to improve the availability of rainwater during and after the rain season. The options include roof rainwater harvesting and ground catchment, a method collecting rain from a plain surface. In both cases the water is stored in reservoirs/tanks. Their size depends on the size of the surface area from which the water is collected and the expected amount of rainfall. The introduction of alternative water provision raised the expectations among the community members that the cost of water will be lower than the current cost of purified pipeline water. This is something that has to be clarified, as the initial cost of constructing a roof rainwater harvesting system or a ground catchment is rather high. These costs will be covered by the CuveWaters project during the pilot phase of the project, but additional systems have to be funded by either the owner of the system or be subsidised by someone.

Residents in Epyeshona unanimously reported that they close down the communal water point during the rain season and resort to the use of rainwater from Oshanas and dams and to some extent from thatched huts or corrugated iron roofs.

Adopting new options of rainwater harvesting, including the use of these free or subsidised sources of water during the rain season, and the non-utilisation of a communal water point is primarily due to the expectation of residents that there will be no water bill to pay during that period. It therefore seems that if such free sources could last till the next rain season, then there really would be minimal use of communal water points. The communal water point is thus in existence/use mainly because rainwater is not available perennially to sustain the residents. It should be noted that residents do not dislike water from the communal water point, which, according to them, provides clean, purified water and has been analysed by "a doctor". It is simply the fact that they regard it as too expensive. The high level of unemployment or underemployment in their area especially among the youth was said to be the main reason for people not being able to pay for water.

People in Epyeshona commonly have herds of livestock. Livestock are part of their way of life and livelihood but often they are not used for regular economic gain. Livestock in central-northern Namibia are commonly kept for socio-cultural reasons. However, livestock also need water to drink and require far more water than what is needed for human consumption. In the absence of any sources of water other than the communal water points, the amount of money a household has to pay for watering their livestock becomes substantial. As was stated above, the provision of water for livestock is central to the inhabitants of Epyeshona. This has to be taken into consideration when providing alternative water sources to this and other rural communities.

Use of alternative free water sources

The tendency to use free water sources for different purposes in the rural village of Epyeshona is almost the same as at the urban site in Evululuko. The alternative water sources at the rural site are mainly old hand dug wells and an excavated dam. The hand dug wells, which commonly are dug in Oshanas, are now partially silted-up. The excavated dam is the result of removal of sand that was used for construction of roads and other large-scale construction in the area, which now has become a dam, collecting rainwater during the rain season.

There is no cost involved in using dam water as it serves as a communal resource for anyone from anywhere. The water is not purified and its quality deteriorates with time after the rain season; residents in Epyeshona are aware of this. Yet, water from silted-up hand dug wells and

the borrow pit is used for all household chores such as for bathing, washing dishes or clothes, making bricks and watering livestock. The use of this free water according to residents increases especially when the pipeline water is closed due to vandalism or when the water bill has not been paid. Importantly, livestock are not allowed to drink from communal water points as long as there is water in the borrow pit or the hand dug wells. This is mostly, according to the residents, because livestock drink a lot of water, which would increase the water bill drastically.

Due to the high costs of pipeline water the community representatives in Epyeshona proposed that they should get assistance to construct more dams that would collect rainwater, which can be used for livestock for free.

This high interest in free water for livestock by rural residents was highlighted at the CuveWaters Stakeholder Workshop where some participants in the rural discussion group insisted that what they called 'existing technologies', i.e. earth dams, should be considered along with alternative technologies such as desalination, artificial groundwater recharge and rainwater harvesting from roofs and the ground-level catchments.

Distance from household

As in the case of the urban site, residents at the rural site disregard the distance that they have to walk for free water. It is not an issue as long as it is for their own good and there is no monetary cost attached to the use of the water. Thus, for example, in Epyeshona people walk more than 2 km to fetch water from the borrow pit, which is located further than the communal water point, which is within approximately 1 km (maximum) from the households that can make use of it. This highlights the importance of service site location in relation to the distance that users have to walk, which is clearly influenced by the cost of the services offered.

4.2.2 Perceptions on infrastructure design

For the rural site the proposed technology options on rainwater harvesting raise no significant issues relating to gender in contrast to results obtained from the urban area where location was very important especially for women. However, for a resource located outside a household, the risk of vandalism is expected to be quite significant. For example, a ground catchment area will have to be fenced off both to prevent vandalism but also to prevent it from contamination and destruction from roaming livestock. Therefore, the design and cost calculations should take these factors into consideration as well.

Rainwater harvesting: Traditional huts versus corrugated iron sheets

Traditional thatched roof huts are obviously not suitable for roof rainwater harvesting, as they not only have a smaller and inappropriate surface for water runoff but also are difficult to fit with a gutter when compared to corrugated iron sheet roofs. These limitations of traditional huts versus huts with roofs of corrugated iron sheets highlight the issue of equity. The poorer residents who cannot afford and do not have corrugated iron roofs may be excluded from the use of this technological option. Conversely, households which have corrugated iron roofs often have a private tap and may not be as interested or in need of the proposed roof rainwater harvesting facilities as those households which do not have corrugated iron roofs and/or private taps.

Costs compared to tap water

There is an important issue of cost with respect to designing and erecting rainwater harvesting facilities compared to the cost of connecting a private tap to a household. This must take into consideration the fact that rainwater harvesting facilities are only useful seasonally and not throughout the year as is the case for pipeline water. Thus the cost of constructing, maintenance of the roof rainwater harvesting system and the cost of water from the system should be lower than the cost of an equal amount of water from a private tap.

4.2.3 Institutional arrangements

Training

Residents stated that they would like to have local people trained so they could do the construction and maintenance of the proposed roof and ground catchment rainwater harvesting systems. This will allow the residents to repair the systems when broken and not to have to rely on people from afar for maintenance. The residents stated that they often experience long waiting times for repairs of water points and pipelines (several months or even over a year). In addition it was said that these repairs are expensive. As indicated earlier, the importance of training and capacity building was a key criteria identified at the Stakeholder Workshop for evaluation of technologies.

Staffing and management

The roof rainwater harvesting systems will be privately owned by individual households and its management lies entirely in the hands of the owners. Nevertheless the training (see above) should include advice in how to manage and operate the roof harvesting systems.

The ground catchment was initially proposed to be privately or communally owned. However, community members suggested that it should rather belong to clusters of households, preferably about five households per ground catchment. According to the residents, there is a need to train representatives from the future household clusters in construction and maintenance of these facilities. Issues such as the operational management and security of the facility will have to be worked out by the users in a given cluster. They will also be the ones to decide on where they want their ground catchment to be located.

4.2.4 Outputs and benefits from rainwater harvesting

Gardens

At the rural site, according to the residents, just a few households in the village have gardens, indicating that gardening is not so popular among the residents. The households that have gardens are among those that have private taps and have relatively large corrugated iron roofs. Among others, insufficient and insecure availability of water appears to be the main reasons for the limited numbers of gardens in the area.

4.3 Additional technologies – desalination and artificial groundwater recharge

As already noted in the introduction of chapter 3, two additional technologies, desalination of groundwater and artificial groundwater recharge, were introduced and discussed at the CuveWaters Stakeholder Workshop in October 2007. Due to the schedule of the implementation process, these technologies have not been discussed with rural communities yet in situation assessments. These are both applicable to rural situations where piped water is not accessible. Both technologies are highly sophisticated but were nevertheless of great interest to the stakeholders at the workshop. As expected, questions about quantity and cost of the water to be produced were queried as water for livestock was said to be of highest priority to people in these more peripheral rural areas, where these techniques would be introduced.

Stakeholders asked many questions about these technologies and identified issues such as disposal of excess salt from desalination and contamination of groundwater associated with artificial recharge. When assessing the importance of implementation criteria, they identified aspects as: community based ownership and responsibility, affordable use, need for training and capacity building, as well as minor impacts on natural conditions as their first considerations. The necessity for an environmental assessment was also identified. The different councillors from the region where these technologies would be tested were in full support of these ideas.

4.3.1 Costs

Cost was not a major point of discussion, particularly after workshop participants were informed that the investment costs would be covered by the CuveWaters project. Although not discussed thoroughly, it was said that the cost of water from desalination would not be higher than for piped water. The cost of artificial recharge would be borne by the water supply institutions (e.g. Rural Water Supply or NamWater) and water obtained from wells thereafter would not cost more than is already paid for water from this source.

People living in the rural areas where desalination and artificial recharge are being considered, currently obtain their water from hand-dug wells at no cost. In a similar rural, livestock farming area piped water was introduced soon after independence (Klintenberg et al. 2007). This attracted many farmers and the increased livestock density had a negative impact on the rangeland (Klintenberg/Verlinden 2007). Piped water was supplied at no cost for several years. When cost recovery was introduced, the farmers were unable to generate the cash required. In response, some have moved further south to establish new hand-dug wells for their households and their livestock. Care must be taken when desalination and artificial recharge are introduced into areas where payment for water services has not been implemented to date.

4.3.2 Perceptions on infrastructure design

Despite illustration by means of graphic and textual material at the CuveWaters stakeholder workshop, the processes of desalination and artificial groundwater raised many questions among participants and full understanding does not seem to have been attained. In the middle of 2008 a number of workshops on community/village level will be held in the area suggested for implementation of the technologies. The workshops should contribute to enhanced understanding of these technologies among community representatives and other stakeholders. The success of using physical models for explanation of the different components of the community unit and rainwater harvesting should be kept in mind when preparing these workshops.

Stakeholders need to understand the full suite of issues surrounding desalination and artificial recharge including not only technical but also environmental as well as institutional and economic issues. Issues concerning management and operation coupled with training and capacity building should be discussed as well. The contribution of the local people and their water committees in relation to that of the water supply agents must be established.

4.3.3 Institutional arrangements

Institutional arrangements concerning artificial recharge and desalination were only briefly touched upon at the CuveWaters Stakeholder Workshop. The stakeholders heard that most of the operation of these technologies would not take place at community level. Nevertheless, the communities will need to know more about the role of their Water Point Committees, if any, and who will tend to the infrastructure on a day-to-day basis. These details require further conceptualisation.

4.3.4 Outputs and benefits from desalination and artificial groundwater recharge

The water gained from desalination and artificial recharge will potentially be used primarily for domestic purposes. People living in the area will, however, want to have additional sources of water for their livestock. A thorough understanding of pricing, quantity and quality of water that will be supplied must be presented and discussed when local level workshops are held with communities, their traditional authorities and their councillors.

5 Conclusions

The enthusiasm of urban and rural communities regarding the proposed technologies discussed during the empirical workshops is encouraging. The community members being part of the workshops at both sites openly expressed their wish that the piloting phase is being implemented soon. Similar support and enthusiasm was shown with respect to the desalination and artificial recharge technologies introduced during the CuveWaters Stakeholder Workshop.

For the urban site the relation between cost for the services (not only the water used) in a community unit and the fair and exact measuring and billing is a crucial point for the willingness to pay and the acceptance to use the community unit. Also a thoughtful design of the infrastructure that respects gender issues and safety will determine its success. Finally an institutional concept has to be developed for operating the Centre in a way that will enable the community to take responsibility for it and also show perspectives of job opportunities. The option of small-scale gardening needs further investigation.

For the rural site the crucial point of consideration is the initial investment cost which is necessary to gain experience with rainwater harvesting methods. At present, the rural residents have little knowledge of rainwater harvesting methods and the initial costs are perceived as very high in relation to the amount of water that can be collected. Mutually shared investment models should be taken into consideration to overcome this. Issues such as the management and maintenance of the infrastructure do not seem to be a problem, since workshop participants opted for privately managed (individual or by clusters of households) rainwater harvesting infrastructure. The utilisation potential and purposes of the collected water on the other hand will need further

discussion. In that regard the need of free or at least very cheap water for livestock was raised and remains an issue to be kept in mind.

The cost of water at the proposed technological facilities, and institutional arrangements regarding the operations of such facilities, are challenges at both the urban and rural sites that need to be addressed and considered by the CuveWaters project. People living in the rural areas where desalination and artificial recharge are being considered mainly obtain their water from hand-dug wells. This water is free; a situation that must be considered when introducing new technologies where cost recovery for operation and maintenance may be expected. The concerns surrounding these issues are not insurmountable and should therefore not dampen the interest expressed by the communities. According to participants at the rural site and the rural discussion group at the workshop, an alternative source of affordable or even free water for livestock, e.g. dams, is also of high importance.

Participants of the CuveWaters Stakeholder Workshop were enthusiastic about the desalination and artificial recharge options. Similar to the urban and rural sites in and near Oshakati, cost is a clear consideration even though people currently depend on at least partially saline hand-dug wells for their domestic as well as livestock use. Further understanding of the implications of the desalination and artificial recharge options, on the part of the communities (who did not attend the CuveWaters Stakeholder Workshop) as well as the service providers who attended the workshop, is essential. And as was identified at the rural site near Oshakati, free or at least very cheap water for livestock is a key concern of farmers in the western parts of the pilot area.

6 Lessons learnt

Based on four situation assessments, two each at Evululuko and Epyeshona, the CuveWaters Stakeholder Workshop held in October 2007 and our own varied experience in the area, the following lessons have been learnt or reconfirmed.

1. Perceptions and exploration of water use patterns: People in the communities involved in the situation assessments participated enthusiastically in all discussions. It is clear that they enjoyed being part of the process and providing their opinions and knowledge. However, in this process, as in many similar processes, it is not clear how much the enthusiasm of the participants reflects their deeply held convictions or simply an idea of interest for the moment reinforced by other participants. Greater institutional triangulation, with the local authorities, with service providers and with the more senior members of the communities working elsewhere, could provide a more balanced opinion of the various points that were not fully resolved and of those points that were firmly stated but later on queried by others. This refers mainly to the following points:
   - Use of canal water by Evululuko residents
   - Use of ‘flying toilets’
   - Need for gender separation and privacy for washing clothes
2. Acceptance of gardening: This was a preconceived idea presented to the communities from the CuveWaters team during the situation assessments. People expressed some limited enthusiasm but spent much discussion time explaining why little gardening takes place in both places and why the community garden is no longer used in Evululuko. Further investigation revealed that a permit must be purchased to sell produce in the markets which costs a cer-

tain amount whether or not produce is being sold. Although not a new lesson, the limited interest shown suggests that gardening is not a high priority to the residents of the two villages. To establish gardening would therefore probably require extensive and ongoing support (including knowledge transfer) to help the residents to, for instance, take advantage of the 'nutrient rich' purified water.

3. Willingness to pay: Several studies have been undertaken by NamWater and other institutions to try to address the question of 'affordability' vs. 'willingness to pay' with respect to water supply. Based on the information provided during the situation assessments, the conclusion that people in the north are more unwilling than unable to pay for water appears to have been reconfirmed. This attitude has many origins. People received free water before independence, apparently because of the interest of the 'second tier government' authorities to maintain their leadership positions. At independence and during the independence struggle, people were told and believed that life would become easier and basic services were their right and would be free. Although policy, legislation and development actions since independence have incorporated and strongly supported the concept of cost recovery, the high level political leaders have not reiterated their support for this approach. Unfortunately, some politicians have gone against their own policy and legislation to advocate for free water as a human right. The impact on the project of the recent request from the Minister for NamWater to open all taps that had been closed due to non-payment deserves further analysis.
4. Acceptance of decentralised sanitation concepts: During the first Evululuko community assessment, one person mentioned that facilities similar to the proposed community unit, although less environmentally friendly, had been built by the white regime for the inhabitants of the neighbouring township during apartheid. This was mentioned in the context of the vandalism that had been experienced with those facilities leading to the conclusion that security would be important for the proposed community unit. This topic was not brought up again by the Evululuko community. Nevertheless, the Oshakati Town Council, probably more politically astute than the residents, has again brought this question to the fore. Further analysis and investigation into the differing perceptions amongst the residents who would use the facilities and the Oshakati Town Council who would be responsible for the facilities is required. Earlier and more extensive interactions with the Oshakati Town Council, together with the community members and on their own, would probably have been adequate and should be considered for the future.
5. Billing and metering at the community unit: This topic was discussed frequently and at length. The project would have to take this further with the authorities, e.g. the Oshakati Town Council, so that any solutions implemented have full support of the authorities and the community.
6. Social marketing and knowledge transfer: All aspects of social marketing and knowledge transfer should be fully integrated into further implementation.

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