EXPERIENCES WITH ECOSAN SYSTEMS TO PROVIDE SUSTAINABLE SANITATION FOR SCHOOLS IN KENYA AND INDIA

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Abstract

Achieving universal primary education is one of the Millennium Development Goals, but to fully benefit from their schooling, the pupils need to be free from disease and hunger. Sustainable sanitation at schools can contribute to improving the health status of pupils (reduced diarrheal disease and intestinal worms). Ecosan-type sanitation systems (here: urine-diversion dehydration toilets i.e. UDDTs and pour-flush toilets connected to biogas plants etc) are particularly suitable for school sanitation in the global South, as the students can easily grasp their concepts and they can appreciate their secondary benefits of fertiliser (to grow crops in school gardens) and biogas (for cooking). This can provide additional motivation and sense of ownership amongst the pupils and staff.

Several ecosan school projects from Kenya and India are described in this paper namely two school pilot projects within the EU-Sida-GTZ Ecosan Promotion Project in Kenya and several projects in India implemented by the Ecosan Services Foundation and various other actors. In all these projects, a sense of ownership and constant capacity development exercises are crucial factors in their success. Students can also be “change-agents” in their communities when they take their experiences back home and teach their family members about sanitation and hygiene.

Keywords: biogas, ecosan, school, sustainable sanitation, UDDT

INTRODUCTION

All schools where pupils, teachers and support staff spend a significant part of their day should have sustainable sanitation facilities, in particular toilets and hand washing facilities. Unfortunately this is not the case in many Asian and African countries. Millions of school children worldwide have to get through their school day without any toilet or with incredibly filthy and unsafe facilities. Also far too many children in developing countries miss many school days per year due to either being sick with preventable diarrheal diseases (due to lacking sanitation facilities in their communities) or due to lack of private and hygienic toilet facilities at their schools (this is a particular problem for adolescent girls during their menstruation days). The lack of hygienic school toilets consequently affects the students’ well-being, their health and ultimately their learning abilities.

The Millennium Development Goal Number 2 is to achieve universal primary education, and one of the indicators is “net enrolment ratio in primary education”. Significant progress towards this goal has been achieved so far but it is difficult to provide the necessary teachers and school infrastructure for a rapidly increasing number of pupils. For this and other reasons,

school toilets are often non-existing or totally inadequate in terms of number of toilets per student and level of hygiene.

The typical school toilet in Kenya and India is a pit latrine – where pits are often overflowing and odorous and the schools have no means to empty the full pits or dig new pits. Such conventional excreta management approaches, be they water-borne or pit-based, treat excreta as a waste which needs to be disposed. The long term sustainability of such purely disposal oriented systems is often lacking due to low financial and technical sustainability. Sustainable sanitation on the other hand, includes all sanitation systems that are economically viable, socially acceptable, technically and institutionally appropriate and protect the environment and resource base (SuSanA, 2008)

There is a wide range of ecological sanitation (ecosan) technologies which can be used which fit the needs of social, economic and environmental sustainability in a given context. They all strive to be sustainable in all aspects i.e. protect the health of the population and to allow safe reuse of nutrients and water (according to the guidelines from WHO, 2006). The challenge nowadays is to implement ecosan systems in cities (SuSanA, 2009a; Bracken et al., 2009; Panesar et al. 2008) and thus also in urban institutions, such as schools, prisons, markets, etc.

Two types of "ecosan toilets" are particularly suitable for urban schools in developing countries: urine-diversion dehydration toilets (UDDTs) and pour-flush toilets connected to a biogas plant. The following reasons back up this statement:

- Ecosan technologies in the form of urine-diversion dehydration toilets are easy to build and understood by the school children, and can be built and maintained together with children and teachers (Shangwa and Morgan, 2009), thus increasing ownership (Arborloo toilets on the other hand are often suitable for schools in rural areas).
- Ecosan technologies in the form of pour-flush toilets connected to a biogas plant and further treatment components (e.g. Fig. 3) can supply biogas for cooking replacing either firewood (thus conserving the vegetation around the school) or reducing costs for having to purchase LPG (liquefied petroleum gas) cylinders.
- Ecosan systems can produce valuable liquid and solid products (e.g. urine, dried faeces, compost, digestate, irrigation water) which can be used as fertiliser in school gardens, where the students can learn how to increase the yield of vegetables by safely applying treated excreta as fertiliser and soil conditioner.
- UDDTs do not rely on soil infiltration, unlike pit latrines, and are more suitable than pit latrines in dense urban settlements, in areas with high groundwater table, hard rock, collapsing ground or seasonal flooding.

If the school children can be convinced of the benefits of sanitation in general, and the special benefits of ecosan systems in particular, they can create a ripple effect and promote the need for sanitation and the concept of ecosan more widely. Schools therefore provide a strong entry point for sustainable sanitation systems in the community (SuSanA, 2009b). This paper describes the experiences and lessons learnt from using ecosan systems in some schools in Kenya and India**..**

SCHOOL SANITATION WITH ECOSAN SYSTEMS IN KENYA

More than half of the Kenyan population do not have access to improved sanitation while the increase in population having access to improved sanitation from 1990 to 2006 has been only 3% (WHO/UNICEF, 2008). Ecosan-type technologies were introduced in Kenya in the late nineties through NGOs with urine-diversion dehydration toilets (UDDTs), Arborloos and Fossa Alternas.

The EU-Sida-GTZ Ecosan Promotion Project (Odhiambo et al. 2008) has utilised this existing experience in "dry excreta management" and engaged the respective NGOs to kick-start activities in their areas. At first NGOs and now predominantly CBOs (community-based organisations) are carrying out the selection of beneficiaries, awareness campaigns, training sessions and construction supervision with technical support by the GTZ-Kenya team. The selection criteria for the benefiting schools included availability of farmland for use of fertiliser and inappropriateness of existing sanitation facilities e.g. pit latrines in areas with collapsing soils, flooding, water pollution etc. In some cases schools had "grave yards" of old, filled pit latrines that took up the entire school compound.

The preparation, design, planning and implementation process was participatory including the school administration and board, local government authorities like area education officer, public health officers and other stakeholders. Furthermore the schools had to cost-share the toilet construction by means of providing locally available materials and unskilled labour (contribution of at least 20% of the total investment costs). Both the participation and the contribution were crucial to create ownership and thereby sustainability of the toilets.

UDDTs at Khaimba Primary School in Butere, Kenya

A successful pilot project within the Ecosan Promotion Program is Khaimba Primary School (1,000 pupils) in Butere, a town in the Western Province of Kenya in the Butere/Mumias District. One 40 m^3 rainwater harvesting tank for hand washing was constructed in conjunction with two units of UDDTs for teachers and two for students.

Fig 1. Left: UDDT school toilet with hand-wash unit connected to rainwater harvesting; right: Pupils in Khaimba Primary School wash their hands with newly installed tippy taps (source: C. Rieck).

A health club was established in the school where students and teachers take up responsibility for the operation, cleanliness and maintenance of the toilets as well as the reuse of the fertiliser in the school farm. The health club is very active, hence the toilets are properly used, and the urine and the excreta-based compost are applied in the school farm for a school feeding program. Common crops on which the fertiliser is used are bananas, maize and spinach. The surplus of the farm products which are not consumed by the school are sold, primarily benefiting the health club members with books and other rewards. This encourages the members to fully engage in the utilisation and maintenance of the UDDTs.

Awareness, training sessions and follow-up monitoring and support are crucial for the success of ecosan in schools. The schools started to integrate ecosan and general WASH issues

(http://www.schools.watsan.net/page/248) in the school's curriculum and school activities. These actions are highly recommended because UDDTs requires a full involvement of the users. They are easily prone to mismanagement as the UDDT user needs to apply ash after defecation (other covering materials are also possible) and keep the faeces chamber dry from urine and water. The UDDT caretaker needs to regularly empty the urine storage tanks and excreta chamber and organise reuse of the fertiliser. Hence a strong emphasis is laid on user and caretaker education, operation and maintenance training for both students and school administration. The main incentive for schools to decide for UDDTs remains the cost advantages compared to costs for regular digging and construction of new pit latrines with limited space at hand.

The use of fertiliser to support school feeding programs thereby reducing costs for food purchases becomes a very important incentive. For schools it is also appealing to raise their social status and image with improved sanitation facilities that are likely to attract more students and funds. The awareness on environmental benefits of ecosan is well understood by the local population, but it is lower-ranking as an incentive for schools.

Toilets with biogas plant at Gachoire Girls High School in Nairobi, Kenya

The Gachoire Girls High School is in the outskirts of Nairobi. 30 low pour flush toilets (800 girl students) are connected to a fixed dome biogas digester with a wetland and 3 double chambered UDDTs are provided for the 40 teaching staff. The biogas is used in the school kitchen to substitute firewood which accounts for a great part of the schools operational costs. The school administration has therefore shown great interest in the biogas in order to save costs. Kenyans have also recognized the potential of biogas to help conserve the increasingly endangered forests. The school has started to successfully use the biogas in the kitchen since its operation. Monitoring is still being carried out to document the lessons learnt.

The reuse of treated wastewater with a high content of nutrients for food production in the school farms or for growing trees and animal feed is also accepted but more complex to carry out. School farms usually rely on rainfed agriculture; hence irrigation plays a limited role and is rarely practiced. Since schools spend up to 50% of their operational costs on food, the outlook of improved food supply from school farms is creating demand. An extended training on irrigation and safety standards for reuse of treated wastewater is planned, especially for agricultural teachers and agricultural student clubs.

SCHOOL SANITATION WITH ECOSAN SYSTEMS IN INDIA

In 2006, India attained MDG coverage of 56% in sanitation (WHO/UNICEF, 2006). The rapid urbanisation in the Indian cities is constantly competing with the constant migration from people in rural areas in search of better employment opportunities. There is lack of affordable housing owing to which people live on streets and slums in unhygienic conditions without any sanitation facilities. The centralised wastewater treatment infrastructures are overloaded and pollute the water bodies.

UDDTs at the Navsarjan Trust schools in rural areas in state of Gujarat, India

Ecosan activities in India are growing and quite a few NGOs are working at the grass root level to raise awareness and acceptance for ecosan technologies. Navsarjan trust is an NGO based in Ahmedabad dedicated to help eliminate caste and gender discrimination and to assure equality of status and opportunities by improving the living conditions of the "Dalits" caste. Manual scavenging has traditionally been a caste based occupation. Innovation in technologies was needed to eliminate manual scavenging practices.

Ecosan Services Foundation (ESF, www.ecosanservices.org), supported by the GTZ Ecosan Program in Germany, has implemented closed loop sanitation concepts in primary schools and a vocational training institute of the Navsarjan trust (http://navsarjan.org/) together with several partners (GTZ, 2007; SuSanA, 2009c). The main selection criteria for schools have been availability of land for farming, water scarcity, human dignity and economic empowerment. Three primary schools with boarding facilities were selected in the Rayka village (Ahmedabad district), Katariya village (Surendranagar district) and Sami village (Patan district) located in the rural areas of the state of Gujarat.

Each school accommodates 210 pupils from the "Dalit" community and has a separate sanitation block which comprises of 8 UDDT with single vaulted squatting type toilets cum showers (4 used as toilets and other 4 used as showers at a time), washing and laundry facilities for the pupils and staff. The dehydrated excreta is used as a soil conditioner in farming. Urine from the UDDTs and waterless urinals is collected in containers and reused as fertiliser. The anal cleansing water is drained into a subsurface irrigation of ornamental flowers. The greywater from the hand washing, showers and laundry is filtered through a vertical flow filter and reused in gardening (GTZ, 2007).

Fig 2. UDDTs at the sanitation facility of the primary school at Rayka village. Left: Faeces dehydration chambers with vent pipes; middle: faeces are sprinkled with dry material, e.g. ash/rice husk; right: 'Young scientists' who received first prize for the ecosan school toilet model (source: ESF).

The toilets have been operational since August 2006. Capacity development activities were conducted with the pupils and staff to change their initial prejudices. The students take turns in maintaining the toilets, and constant supervision of the facilities is required to ensure their proper use. Especially the pupils who are new to the school usually make mistakes such as adding water to the faeces dehydrating chambers without understanding the reason for keeping these chambers dry. The students need to be continually trained and educated on the use of the toilets and the system.

In the beginning, the teachers of the school enforced the use of toilets instead of defecating in the open to the pupils but they themselves continued to defecate in the open by the force of habit and preconceived notions about the toilets being smelly and unhygienic. The children then persuaded the teachers to use the toilets and thus have been instrumental in changing the prejudices of their school teachers. The pupils are now well versed with the use of the ecosan UDDTs. They constructed a model of the ecosan toilet demonstrating the collection, storage and reuse components of the system and were awarded the young scientists award at the Ahmedabad school science fair.

Pour-flush toilets with biogas plant at Adarsh Vidya Mandir school (Badlapur, India)

At Adarsh Vidya Mandir School there is another ecosan school project located about 69 kilometers from Mumbai city in Badlapur town in the state of Maharashtra. Around 11,000 students attend this school and college. The management of the college together with the municipal council of the town of Badlapur, ESF supported by the GTZ Ecosan Program, Seecon GmbH (Switzerland) and other partners jointly planned in 2006 how to refurbish the existing inadequate sanitation facility with an ecosan system.

Fig 3. Low-flush pour-flush urine diversion toilets at Adarsh Vidya Mandir school (source: ESF). Left: New toilet centre in 2008; right: technical drawing of sanitation system of the school.

The sanitation block consists of five low-flush pour-flush urine separation toilets provided with small buckets of water for flushing and 15 waterless urinals in the men's block and 15 low-flush pour-flush urine separation toilets in the women's block along with hand washing facilities in both. The wastewater from the toilet blocks is subjected to anaerobic decomposition in a biogas settler. The effluent from the biogas reactor is then passed through an anaerobic baffled reactor for further anaerobic treatment and through a horizontal-flow constructed wetland and finally drained into a polishing pond (SuSanA, 2009d).

The sanitation facilities are operational since September 2008. A small portion of the collected urine is used in gardening while the remaining is drained into the biogas settler. The municipal council of the Badlapur town has offered to utilise the sanitised urine as fertiliser in the municipal gardens in the near future. The treated wastewater is used for gardening purposes.

The sanitation facility is maintained by trained people. In the first few months since start of operation in September 2008 it was observed that there was a lack of ownership from the students as their involvement has been limited to only using the toilets. There have been incidents of destructive behaviour such as throwing stones embanking the polishing pond into the pond. Capacity development exercises were then conducted to explain to the students the ecosan system and its importance. There have not been any similar incidents since then. Activities such as student's participation in gardening activities and introduction of the sustainable sanitation concepts into the curriculum are planned to increase ownership amongst students.

CHALLENGES AND WAY FORWARD WITH ECOSAN SYSTEMS IN SCHOOLS

Schools have the routine of rotation and replacement of students every year as well as occasionally of teachers and school management. Thus learnt knowledge and experience on operation and maintenance of UDDTs, anaerobic treatment facilities and proper use of biogas, water and nutrients might get lost for the school. Hence a continuous demand to replenish this knowledge to the arriving new students and teachers is essential in order to prevent

mismanagement and abandonment of ecosan installations. It is therefore recommended to include sustainable sanitation and ecosan in as many activities of the school as possible to make them a part of their daily lives.

Only when these installations have proven successful to the schools, and advantages compared to the conventional systems like pit latrines in terms of odour, costs, hygiene and fertiliser productivity are clearly observed, ecosan will be a feasible choice for school sanitation in future. Ongoing monitoring and evaluation of ecosan installations is necessary to determine their performance and practicality for schools for large-scale roll-out.

Another very important component for ecosan promotion in schools is the linkage to the policy level, the research and educational sector. The Ministry of Water and Irrigation in Kenya has already taken a promising step and included ecosan in its Water Sector Sanitation Concept (WSSC) in 2008. Other sector institutions like the Ministry of Public Health and Sanitation, the Ministry of Education and Ministry of Agriculture have shown interest in adopting ecosan as one option of sanitation intervention. On the research and educational level the Kenya Water Institute (KEWI) and the Kenyatta University are introducing training and curriculum on ecosan.

In India, the Indian central government is planning to introduce sustainable sanitation as part of the curriculum in schools starting with the 10,000 Central Board of Secondary Education (CBSE) schools through its Urban School Sanitation Program (www.schoolsanitation.com). Here a whole range of measures and activities will be included such as:

- Awareness raising through inclusion of sanitation as curriculum in the schools
- Preparation of school sanitation manual as a handbook of best practices with reuse of water and advanced waste management in schools
- Sanitation rating of schools and appreciation through National Urban School Sanitation Awards
- Orientation program for the school principals
- Inclusion of sanitation as a requirement for school accreditation/affiliation by CBSE
- Creation of the brand value for the sanitation initiative by having a sanitation brand ambassador and sanitation week

The long term goal is to ‘Educate them young’ to achieve improved sanitation.

CONCLUSIONS

In the ecosan school projects in Kenya and India described in this paper, ecosan-type sanitation systems (UDDT or pour-flush toilets with biogas plants) have received acceptance due to their lack of odour, additional economic benefits and cost savings. Capacity development on the concept of the ecosan-type sanitation systems and their use is a constant exercise for the success of such projects. Moreover there is a need to develop ownership among the users to ensure proper use and maintenance of the toilets. The students, through their experience at their schools, can play an important role in spreading knowledge of sanitation and hygiene in their communities.

A potential strategy to boost ecosan for schools may be by incorporating it into the curriculum and by tying ecosan-type sanitation systems to WASH initiatives, school gardening activities and school feeding programs. This and many more actions will improve publicity and governmental support for sustainable sanitation approaches in urban schools with ecosan as one of many components.

ACKNOWLEDGEMENTS

We would like to express our gratitude to Arne Panesar (GTZ), Dayanand Panse (ESF) and Pradnya Thakur (ESF) for their valuable contributions to this paper.

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