



Sustainable Sanitation in India

Examples from Indo-German Development Cooperation





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A Preface – Government of India



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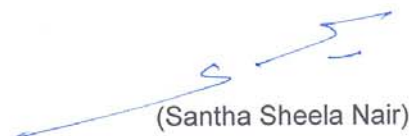
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PREFACE

Safe Sanitation and Water are fundamental to the human development. When people face deprivation in these areas, they face diminished opportunities to realize their potential as human beings and inadequate unsafe water and sanitation are two important determinants of global poverty and inequality. They claim millions of lives, destroy livelihoods, compromise dignity and diminish prospects for economic growth.

Overcoming the crisis in sanitation and water is one of the greatest human development challenges of the 21st Century. Success in addressing the challenge through a concerted national and international response would act as a catalyst for public health, education, poverty reduction and impetus for economic growth. It would give a decisive thrust to realization of Millennium Development Goals, the targets adopted by the Governments as part of global partnership.

The booklet **Sustainable Sanitation in India** describes the initiatives from the Indo-German Development Co-operation to India's effort to provide Sustainable Sanitation to All. It highlights the activities of different actors in the German Development Cooperation, which all contribute in different ways and on different levels to achieve a common goal. The document is focused on the work done by **gtz, Borda and KfW** as partners of the **Sustainable Sanitation Alliance (SuSanA)** and its Indian partners like **Ecosan Services Foundation (ESF)**.


(Santha Sheela Nair)

Place: New Delhi
Dated: November 07, 2008

स्थायी पेयजल आपूर्ति
सभी के लिए स्वच्छता - 2012

Sustainable Drinking Water Supply
Sanitation for all-2012

B Preface - GTZ

Rural and Urban water issues have been addressed by Indo-German development cooperation for several decades and along with sustainable development in general it can be considered as one of the oldest topics covered. Indo-German joint activities focus on the sustainable management of water resources with due consideration to social and institutional issues. However, the initial rural and urban water programmes have had little in common with contemporary challenges, which address the topic "sustainable sanitation" in the context of rapid urbanisation and increased pressure on environmental resources in a holistic way.

Today provision of sustainable sanitation is identified as a key-driver for economic development and sustainable development in general. In recent years this has become more and more clear around the globe and had led the UN General Assembly to declare the year 2008 as the "International Year of Sanitation (IYS)".

We underline that the achievement of the sanitation Millennium Development Goals (MDGs) is one of the major challenges for sustainable development in the next decade. With this publication emphasis is laid on accelerating the implementation and the role-out of large scale innovative and peoples driven sustainable sanitation projects. Business as usual is not enough: we need a paradigm shift towards a holistic view on sustainable sanitation!

Dr. Günter Dresrüsse,
GTZ - Country Director - India
9. November 2008, New Delhi, India

C Acknowledgements

This publication profiles contributions from the Indo-German development cooperation to India's effort to provide sustainable sanitation to all. It is largely drawn from the work done by GTZ, CIM, BORDA and KfW as partners of the Sustainable Sanitation Alliance (SuSanA) and its many Indian partners from the Government of India to the grass root level. At the same time it brings together selected contributions from GTZ, KfW, BORDA and CIM for Indo-German Development cooperation in India.

The BMZ-GTZ-ASEM-programme, India, and the BMZ-GTZ-ecosan-programme, Germany, largely financed the production of this document. In-kind contributions were made by BORDA, KfW and CIM are all gratefully acknowledged. The Ecosan Services Foundation, Pune, was the focal point in India for bringing the contributions together and for layout and printing.

We would like to sincerely thank all the involved individuals and organisations from German Development Cooperation, and their very active Indian and international partners for their strong input and contributions provided for this publication.

Being published in the UN-International year of sanitation and in the 50th year of Indo-German development cooperation, the organisations and partners involved hope that the solutions presented here, will help to accelerate the demand driven and peoples centred actions on the ground to provide sustainable sanitation solutions and thereby contribute to reaching the Millennium development goals related to sanitation.

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1 Motivation – achieving the sanitation related Millennium Development Goals with sustainable solutions

1.1 Sustainable sanitation – a pressing global task

For many years, the international focus has been to provide safe drinking water supply. The Millennium Development Goals (MDGs) however represent a clear commitment to address sanitation with the same priority as water supply.

An analysis of existing data on global sanitation coverage from most recent international reports (e.g. Rosemarin et al. 2008) however reveals that of all the MDG targets movement on sanitation provision has been the slowest. In his address to the high-level segment of 16th meeting of the UN-Commission for Sustainable Development (CSD) in May 2008 the UN Secretary General Ban Ki Moon therefore urged governments and stakeholders to move the sanitation crisis to the top of the international agenda (<http://www.un.org/esa/sustdev/csd/review.htm>).

How best to achieve the Millennium Development Goals had already been discussed in the report “Health, dignity, and development: what will it take?” (UN Millennium Project 2005). Hans Olaf Ibrek, Member of the “MDG Task Force on Water and Sanitation” points out during the launching of the report: “Efforts to reach Target 10 must focus on sustainable service delivery, rather than construction of facilities alone”.

The world-wide endorsement of the Millennium Development Goals calls for a radical re-thinking of the conventional, accepted approaches to urban infrastructure in general and sanitation in particular. Only a change in the basic paradigm from linear flow streams and disposal towards a cycle oriented management of renewable resources has the potential to deliver the kind and degree of change which the millennium development goals demand. Just how difficult it is to change from conventional approaches to better alternatives is demonstrated by the fact that visionary engineers proposed to move from the linear to circular systems of managing water and wastewater (including excreta, and rainwater) back in the 1970s (Schaeffer and Stevens 1983). Today, 35 odd years later, the circular approach remains the exception.

Box 1: Millennium Development Goals and the Johannesburg Plan

The **Millennium Development Goals** aim to:

Eradicate extreme poverty and hunger; Achieve universal primary education; Promote gender equality and empower women; Reduce child mortality; Improve maternal health; Combat HIV / AIDS, malaria and other diseases; Ensure environmental sustainability; Develop a global partnership for development. With particular regard to water issues the goal of ensuring environmental stability the United Nations adopted the target of halving the proportion of people without sustainable access to safe drinking water by 2015. (United Nations 2000: United Nations Millennium Declaration – September 2000)

Johannesburg Plan of Implementation

In the Johannesburg Plan of Implementation the goals of the United Nations Millennium Declaration were reaffirmed and further elaborated. With respect to the MDGs and water supply and sanitation they aim to:

(1) Halve, by 2015, the proportion of people without access to safe drinking water – thus reaffirming the target set in the Millennium Development Goals and

(2) Halve, by 2015, the proportion of people who do not have access to basic sanitation.

(United Nations 2002: Key commitments, targets, and timetables from the Johannesburg plan of implementation)

1.2 The modern concept of sustainable sanitation

The basic concept of collecting domestic liquid waste in water-borne sewer systems, treating the wastewater in centralised treatment plants and discharging the effluent to surface water bodies became the accepted, conventional approach to sanitation in urban areas in Europe in the last century. Although these conventional sewer systems have significantly improved the public health situation in those countries that can afford to install and operate them properly, the large number of people, particularly in fast developing countries like India, who still do not have sufficient access to adequate sanitation is a clear indication that the conventional approach to sanitation is likely to be unable to meet the needs universally.

The conventional sewer system was developed at a time, in regions, and under environmental conditions that made it in many cases an appropriate solution for removing liquid wastes from cities. Today with increased population pressure, changes in consumer habits and increasing pressure on freshwater and other resources, this human waste disposal system is no longer able to meet the pressing global needs alone.

A few decades ago it thus became a priority to:

- Identify appropriate simple, affordable decentralised sanitation systems and promote their adoption
- Implement appropriate technologies with the participation of the communities to be served, and
- Focus on health and hygiene education so that physical facilities would be properly used and maintained, and that hygienic behaviour would support the improvements brought about by the infrastructure.

Over the years, it became clear however that this health and hygiene driven paradigm shift was still incomplete: In practice faecal sludge management problems were often overlooked, as were negative downstream effects of effluents from sewer systems. Protection of the environment, resource conservation and waste reuse remained secondary concerns at best, or were neglected entirely, and operational problems reduced the health improvements expected of the technologies.

The Sustainable Sanitation Alliance has therefore called for a paradigm shift from disposal towards reuse oriented sanitation systems, which take all dimensions of sustainability into account (SuSanA 2008).

In addition to paying particular attention to the health aspects at household level, a holistic and reuse-oriented sanitation approach also emphasises:

- The destruction of pathogens through flow stream separation, containment and specific treatment.
- Resource conservation through a reduced use of potable water as a transport medium for human waste and by recovering wastewater for irrigation
- The elimination or minimisation of wastewater discharges to the environment
- The need to close the resource loops through the productive use of the nutrients and energy (biogas) contained in excreta

Thus ideas of recycling have been developed. This modern concept represents the paradigm shift initiated in response to satisfying the health needs of unserved, mostly poor population groups (see BOX 2).

Box 2: What is sustainable sanitation?

Sustainable sanitation has recently been characterised by the Sustainable Sanitation Alliance (SuSanA):

“The main objective of a sanitation system is to protect and promote human health by providing a clean environment and breaking the cycle of disease. In order to be sustainable, a sanitation system has to be not only economically viable, socially acceptable, and technically and institutionally appropriate, it should also protect the environment and the natural resources” - SuSanA (2008).

When improving an existing and/or designing a new sanitation system, sustainability criteria related to the following aspects should be considered:

- (1) **Health and hygiene:** includes the risk of exposure to pathogens and hazardous substances that could affect public health at all points of the sanitation system from the toilet via the collection and treatment system to the point of reuse or disposal and downstream populations. This topic also covers aspects such as hygiene, nutrition and improvement of livelihood achieved by the application of a certain sanitation system, as well as downstream effects.
- (2) **Environment and natural resources:** involves the required energy, water and other natural resources for construction, operation and maintenance of the system, as well as the potential emissions to the environment resulting from use. It also includes the degree of recycling and reuse practiced and the effects of these (e.g. reusing wastewater; returning nutrients and organic material to agriculture), and the protecting of other non-renewable resources, for example through the production of renewable energies (e.g. biogas).
- (3) **Technology and operation:** incorporates the functionality and the ease with which the entire system including the collection, transport, treatment and reuse and/or final disposal can be constructed, operated and monitored by the local community and/or the technical teams of the local utilities. Furthermore, the robustness of the system, its vulnerability towards power cuts, water shortages, floods, etc. and the flexibility and adaptability of its technical elements to the existing infrastructure and to demographic and socio-economic developments are important aspects to be evaluated.
- (4) **Financial and economic issues:** relate to the capacity of households and communities to pay for sanitation, including the construction, operation, maintenance and necessary reinvestments in the system. Besides the evaluation of these direct costs, also direct benefits e.g. from recycled products (soil conditioner, fertiliser, energy and reclaimed water) and, external costs and benefits have to be taken into account. Such external costs are e.g. environmental pollution and health hazards, while benefits include increased agricultural productivity and subsistence economy, employment creation, improved health and reduced environmental risks.
- (5) **Socio-cultural and institutional aspects:** the criteria in this category evaluate the socio-cultural acceptance and appropriateness of the system, convenience, system perceptions, gender issues and impacts on human dignity, the contribution to food security, compliance with the legal framework and stable and efficient institutional settings.

Most sanitation systems have been designed with these aspects in mind, but in practice they are failing far too often because some of the criteria are not met. In fact, there is probably no system which is absolutely sustainable. The concept of sustainability is more of a direction rather than a stage to reach. Nevertheless, it is crucial, that sanitation systems are evaluated carefully with regard to all dimensions of sustainability. Since there is no one-for-all sanitation solution which fulfils the sustainability criteria in different circumstances to the same extent, this system evaluation will depend on the local framework and has to take into consideration existing environmental, technical, socio-cultural and economic conditions.

Taking into consideration the entire range of sustainability criteria, it is important to observe some basic principles when planning and implementing a sanitation system. These were already developed some years ago by a group of experts and were endorsed by the members of the Water Supply and Sanitation Collaborative Council as the “**Bellagio Principles for Sustainable Sanitation**” during its 5th Global Forum in November 2000:

- (a) Human dignity, quality of life and environmental security at household level should be at the centre of any sanitation approach.
- (b) In line with good governance principles, decision making should involve participation of all stakeholders, especially the consumers and providers of services.

1.3 India is on track to achieve the sanitation MDG – however: sustainability is key to long term success

Despite its vastness and population of more than 1 billion, India is working hard and successful in providing water and sanitation facilities to its people. The Joint Monitoring Programme (WHO/UNICEF) 2004 report states that India has succeeded in providing 86% of its population with improved water supply and 33% with improved sanitation. Because of the slow progress in sanitation, the government of India, both at central and state levels, has increased activities and funding, and has committed to achieving the sanitation MDG target by 2012.

Water supply and sanitation is a State responsibility under the Constitution of India and following the 73rd and 74th Constitutional Amendments, the States give the responsibility and powers to the Panchayati Raj Institutions (PRIs) and Urban Local Bodies (ULBs). States generally plan, design and execute water supply schemes (and often continue to operate them) through their State Public Health Engineering Departments (or as in the case of some states, Panchayati Raj Engineering Departments or Rural Development Engineering Departments) and Water Boards. However, the Centre has seen the need over many years for coordination and harmonisation of standards. It has also been responsible, through the Five Year Plans, for guiding much of the investment in the sector as well as for improving financial instruments for infrastructure implementation in the states.

Similarly, it has taken a lead in recommending styles of water supply and sanitation organisations, in promoting the needs for training and research, and most recently in promoting water quality monitoring and human resources development programmes. In addition, a variety of different government institutions at the Centre have a role in the management of drinking water supply as the government strives to fulfil its responsibilities for water resources coordination, pollution control and financing of infrastructure development.

A variety of central institutions are involved with water supply and sanitation, either directly or indirectly. The Central Water Commission (CWC) in the Ministry of Water Resources (MoWR) has responsibilities for regulating the use of surface water for irrigation, industry and drinking water purposes. The CWC also mediates in inter-state water allocation disputes. The Central Groundwater Board (CGWB) of the same Ministry has an overseeing responsibility for the monitoring of groundwater levels and rates of depletion, as well as production of water resource inventories and maps.

The rural sector has a strong water supply sector reform agenda, based on a paradigm shift towards decentralisation, demand responsiveness and peoples centred approach, increasingly taking the role of government from a direct service provider to a facilitator. Likewise, the Total Sanitation Campaign (TSC) approach of the Restructured Centrally Sponsored Rural Sanitation Programme (RCRSP), which is based on the successful model of Midnapur (West Bengal), is also being adopted in other districts of the country with appropriate changes to suit the local conditions and perceptions.

In the urban context the 10th five year Plan places significant emphasis on Urban Water Supply and Sanitation (UWSS). In November 2008 a national urban sanitation strategy has been presented by the Ministry for Urban Development, GOI, that names “Open defecation free cities” and “Promoting recycle and reuse of treated wastewater for non-potable applications” among the focal policy goals.

The national rural sanitation programme of the Indian government began in 1986. It has evolved into the Total Sanitation Campaign (TSC), which now operates in 578 districts of 30 states/union territories and is resourced with over US\$1 billion, to reach India's rural population of 71%. TSC successfully encourages households to finance their own toilets while giving financial incentives to poorer people. The 1% average annual progress of 1981-2001 grew to 3% in 2002-2007 and presently suggests an annual growth of 5-7%. A nationwide network of Rural Sanitary Marts and Production Centres has been established with government funds, although they are run primarily by NGOs and CBOs. (Community Based Organisations) This has boosted the supply chain, promoting sanitation and hygiene, catering to 138 million rural households of which around 55% are still without toilets. Lessons

from three decades of a government-driven programme suggest that visionary policies, combined resources, a strong institutional setting and decentralised delivery are key to reaching at least half of the population without toilets by 2012, the end of India's 11th five-year plan. Although progress is uneven, models in West Bengal, Maharashtra and elsewhere show how informed strategies, strong peoples participation, strong monitoring and political determination yield results that can be scaled up rapidly.

Efforts are being intensified by the Government of India (GOI) to focus on provision of sanitation in schools and communities. Awards have been created like **Nirmal Gram Puruskar**, which is an incentive scheme to add vigour to the sanitation drive by local self governments. To achieve the paradigm shift in rural sanitation in India the GOI uses innovative financial incentives as part of the larger total sanitation campaign and has empowered people to innovate and implement successful models across the country. These models include rural sanitary marts and production centres including outlets not only to provide the materials required for construction of sanitary latrines and other facilities, but also items required as a part of the sanitation package. The rural sanitary mart also serves as counselling centre for those interested in building a toilet on their own. Nongovernmental organizations and local governments have established such marts in remote areas.

On state level innovative community-led approaches for total sanitation in Tamil Nadu, Maharashtra and West Bengal have taken huge strides in rural sanitation in the last four years, largely as a result of adoption of a community led total sanitation approach. The five types of innovation — technology, procurement, community mobilization, monitoring and financing at micro level — are a model for other states to follow and to achieve the MDG goals.

NGOs (both national and international) have played a significant role in the sector in India over the past three decades. Due to their decentralised structure they have exhibited comparative advantages that other organisations lack. These include the capacity to: (i) reach the rural poor and remote areas (ii) promote local participation (iii) operate at low costs, and (iv) adapt and be innovative on local level when needed. The initial involvement of NGOs in the sector came in the sixties with the famines in Bihar (1964) and Maharashtra (1969).

Several external multilateral and bilateral agencies provide assistance to the sector in India. Some of the external support agencies (ESAs) include the bilateral agencies of Japan, the United Kingdom, the United States, Denmark, Sweden, Germany, Australia, Netherlands, etc and multilaterals such as the World Bank, WHO, UNICEF, Water and Sanitation Program – South Asia, UNDP, and the European Union. While in percentage terms the levels of external donor assistance in relation to government investments have been falling, ESAs have made valuable contributions to the sector in terms of supporting demonstration and experimentation at the project level, research, introduction of technological innovations, etc. More recently, ESAs have supported reform agendas – most recent donor assisted projects have emphasized innovative features as conditions for lending, such as user participation, cost sharing and cost recovery. They have also adopted an integrated demand oriented approach to sector operations.

Therefore India is now on track in achieving the sanitation development goals. However, the Government of India is underlining, that long-term sustainability of the achieved sanitation coverage rates and of the services and infrastructure implemented is key and needs to be the heart of all efforts. This aim can not be reached with “business as usual” alone. While the Indian “Total Sanitation Campaign” (TSC) is one of the large scale Programmes of the Government of India (GOI) that bring innovation into sanitation provision and has strongly contributed to demand creation and increased ownership for sanitation on the ground, India clearly appreciates the joint activities under the Indo-German development cooperation in the field of sanitation, which addresses aspects of how sanitation systems can be made economically and ecologically more sustainable, as well as socio-cultural appropriate and accepted. (See Box 3)

This publication therefore illustrates activities of the Indo-German development cooperation, all geared towards achieving sustainable sanitation for all in India. The following chapters therefore describe how sustainable sanitation is currently put forward on an international level (Chapter 2.1), how important it is to do capacity development on all levels (Chapter 2.2), and a few examples of sanitation-projects undertaken in the Indo-German Development Cooperation (Chapter 2.3).

Box 3: Linking the “Total Sanitation Campaign” to long-term sustainability aspects**India strengthens the link between its successful “Total Sanitation Campaign” and long-term sustainability aspects at a National Workshop in New Delhi**

A workshop on sustainable sanitation was organised from 19th to 20th May 2008 by the Government of India (GOI, Ministry for Rural Development, Department of Drinking Water supply), together with CSE (Centre for Science and Environment, Delhi) and ESF (Ecosan Service Foundation, Pune). The idea for and potential of such a workshop had been discussed in November 2007, at a meeting of the Sustainable Sanitation Alliance (SuSanA) in New Delhi. GTZ, SEI (Stockholm Environmental Institute), UNICEF and a group of organisations active within SuSanA contributed to the preparation process.

The overall goal of the workshop was to discuss and plan how to achieve the sanitation MDGs in India using systems that are as sustainable as possible. It highlighted the success of large Indian Government programmes such as the Total Sanitation Campaign (TSC) and focused on a range of innovative and sustainable approaches to sanitation, particularly ecological sanitation. The workshop made clear that combining these innovative elements has a great potential to increase demand for hygienically safe, socially acceptable, environmentally sound and economically affordable sanitation solutions.

The workshop was attended by nearly 300 participants, among them Government Representatives from 22 Indian States and from the Central Government of India. It thereby formed a platform for sharing experiences and exchanging ideas on sustainable sanitation services between government agencies and a range of stakeholders including UN- and donor-agencies, non-governmental organizations, local bodies, women self help groups, financial institutions, legal bodies, designers, architects, town planners and sanitary materials manufacturing industries. The recommendations for actions drafted at the workshop and discussed with all participants now contribute to the development of an Indian sustainable sanitation action plan.

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2 Contributions to sustainable sanitation in Indo-German development cooperation

2.1 SuSanA - an international meta network to support sustainable sanitation provision

The Sustainable Sanitation Alliance (SuSanA) was initiated in January 2007 by GTZ and SEI (Stockholm Environment Institute) in order to provide a global focus on sanitation and to provide capacity and knowledge within the sector.

The goals and objectives of SuSanA are to raise awareness about the need for sustainability within the sanitation sector and sanitation systems, to promote such systems at a large scale, to identify the key role that sanitation plays in human development and the MDGs, to emphasise the importance of stakeholder participation in sanitation and hygiene planning and programme execution and help change the general attitudes about sanitation from a disposal-oriented one to a more reuse-oriented one.

As of November 2008 it had 100 participating organisations (Figure 1). These vary from NGOs and expert consultancies to research organisations, UN agencies, bilateral donors and development banks.

Fact sheets are being produced by various working groups. Each of the working groups summarises the latest state of knowledge. In addition a resource DVD has been produced and a website has been launched containing all the knowledge products.

SuSanA has held several meetings hosted by participating partners in Europe, North America, Africa and Asia during its two first years of operation. At present its secretariat is housed at GTZ in Germany with administrative support from SEI/EcoSanRes in Stockholm.

Products on the following topics are produced by SuSanA's working groups, and are thereby linking sustainable sanitation to a range of other themes such as:

- capacity development
- costs & economics
- renewable energy/groundwater/
- climate change
- technology options/hygiene/health
- food security
- cities & planning
- community & rural sanitation
- emergency & reconstruction
- sanitation as a business
- public awareness & marketing
- operations & maintenance

A range of Indian individuals and organisations (e.g. UNICEF-India, Cap-Net India, Sulabh, Ecosan Service Foundation Pune, etc) are active partners of the SuSanA and thereby ensure on one hand that Indian success-stories like the TSC become internationally known, and on the other hand that latest developments in the field of sustainable sanitation from SuSanA's thematic working groups are channelled into the sanitation sector in India.

sustainable sanitation alliance

www.susana.org

Sustainable Sanitation is

- economically viable
- socially acceptable
- technically & institutionally appropriate
- protects health, the environment & natural resources

SuSanA Goals & Objectives

- raising awareness about sustainable sanitation systems & promoting them on a large scale
- highlighting the key role of sanitation in achieving the Millennium Development Goals
- sustainable sanitation systems planned with stakeholder participation & hygiene promotion
- change of paradigm from mainly disposal-oriented to more reuse-orientated sanitation

Eleven Thematic Working Groups

linking sustainable sanitation and:

- capacity development
- costs & economics
- renewable energy/groundwater/ climate change
- technology options/hygiene/health
- food security
- cities & planning
- community & rural sanitation
- emergency & reconstruction
- sanitation as a business
- public awareness & marketing
- operations & maintenance

88 participating organisations

Figure 1: The Sustainable Sanitation Alliance (SuSanA) –objectives, activities and partners. (Version May 2008)

2.2 Capacity development for sustainable sanitation

Knowledge of sustainable sanitation and especially on ecosan-related issues has increased considerably in India over the last decade, as has the number of sustainable sanitation pilot projects. This period can be seen as a phase of primary advocacy which now needs to move towards a phase of wider dissemination of the latest scientific research results, capacity building and training for a new generation of professionals to prepare them for jobs in the sustainable sanitation sector.



Figure 2: India's Minister for Rural Development Dr. Raghuvansh Prasad Singh, reiterated what he had said during a Government of India workshop on Sustainable Sanitation on May 19th 2008: "We should join hands for a large and inclusive capacity initiative on sustainable sanitation throughout India. With the successful Total Sanitation Campaign we are going to achieve in our country the MDG-target on sanitation by 2012. A capacity initiative should ensure the sustainability of the ongoing activities at long-term."

From left to right: P. Kumar (Unicef), C. Ruben (SEI), A. Panesar (GTZ), Minister for Rural Development Dr. Raghuvansh Prasad Singh (GOI), J Heeb (Seecon), State Secretary Smt. Shanta Sheela Nair (DDWS, MoRD, GOI), Dr. K. Mazumdar (Deputy Advisor to the GOI on the TSC) (Source: GTZ, seecon)

The minister for rural development, Dr. Raghuvansh Prasad Singh had recently underlined that India needs a large capacity development initiative to promote and introduce sustainable sanitation solutions throughout the country (Fig.2)

Whilst the resource base of experts is currently limited in India and around the world, it can still be geared towards an effective leverage function for sustainable sanitation activities. The academic and professional resource base has to focus on inspiring local and national authorities, institutions and other active partners in all parts of the country, to engage them in training and research, and to get their inputs for up-to-date training and capacity development measures.

As no organisation can meet the immense demand for capacity development for sustainable sanitation in India, GTZ encourages other partners in the Indian network to join forces and to jointly develop the training capacities needed.

The development of a set of "sustainable demonstration and knowledge resource centres in India" might as well be an appropriate measure to meet the huge demand. They could include international know-how on sustainable sanitation, and form a series of dynamic research and knowledge

management institutions that can provide support in training, research and development, and on demonstration and pilot projects, in order to build regional capacity in all parts of the country. Linking this activity to the series of international thematic working groups of the SuSanA would allow to ensure that the latest knowledge available is properly shared among the leading specialists and all institutions involved.



Figure 3: The topic “sustainable sanitation” needs to be included into the curricula of schools, colleges and universities.

These students of the Adarsh Vidya Mandir College at Badlapur near Mumbai follow a lecture given on the sustainable sanitation system at their school
(Front right: the Principal of the school; source GTZ)

2.2.1 Capacity development for sustainable sanitation – GTZ-ppp supported “ecosan laboratory” combines education and Information-Education-Communication (IEC) projects

GTZ had initiated the “Innovative Ecological Sanitation Network, India” in 2004. The Indian Water Works Association (IWWA) is one of the active partners in this network. Under its public-private-partnership (PPP) facility GTZ has as well supported the development of open-source ecosan capacity development curricula and courses by its partners.

The Ecosan Service Foundation, Pune, a partner organisation supported by this project, has developed and conducted 14 ecosan training courses during the last 18 months. These were attended by more than 300 experts and created considerable demand for more such courses. Special ecosan-crash courses were developed for example in response to a demand from the Department for Drinking water and sanitation (DDWS), GOI to train the leaders of the TSC in a holistic approach to sustainable sanitation. Other courses were designed according to requests from the WHO, SEI, or from NGOs – for example training for trainers courses (see Fig. 5 for list of courses).

Presentations, workshops and curricula have to be strongly tailored to the target group they are meant for. Further more an awareness raising workshop will differ from a project-start-up workshop or a decision-making workshop as not only the target group in general but also the specific geographic and socio-cultural context has to be addressed. Teachers in Gujarat need different inputs than masons in Kerala who construct urine-diversion dehydration toilets (UDDTs) and household size biogas plants. Hence no two presentations, workshops, curricula will be alike, if such differences are well addressed.

Project Box 1: The GTZ-ppp project “Capacity building for sustainable sanitation in India”

The aim of the project “Capacity Building for sustainable sanitation in India by setting up a training centre (ecosan learning Laboratory) for training of local ecosan experts” implemented under the GTZ public private partnership (PPP) facility is to generate and strengthen local capacities for the implementation of ecological sanitation and to facilitate the transfer of knowledge at the individual, institutional and inter-institutional levels.

To achieve this aim, the project trains local stakeholders from various fields (engineers, planners, municipalities, NGOs, etc.) in the implementation of ecosan projects through various instruments - a training laboratory for sustainable sanitation infrastructure, training courses in ecological sanitation, and an ecosan model park - and at the same time further spreads knowledge by including all course participants in a nationwide network, raising awareness at local and national level.

Partners in the project are the SEECON GmbH Limited, a company, based in Switzerland, for international project management services promoting sustainable management and engineering projects, Shital Ceramic Works (SCW), an Indian manufacturer of sanitary ware and cement articles, based in Gujarat/India, Indian Water Works Association, Mumbai, India, MJP – Maharashtra Jeevan Pradhikaran, Mumbai, India and the ecosan services foundation (ESF), Pune, India.

In the frame of the project SCW has jointly with the other partners designed and produced sanitary ware, specially suited for Urine-Diverting Dehydration Toilets in India (see Figure below).

Other important outcomes are the series of ecosan-training courses, combined with a set of IEC-projects and the series of ecosan-projects conducted by the course participants as part of the educational activity. Based on these experiences with ecosan courses conducted in India, ESF and SEECON offer now a full-fledged training course in ecological sanitation for developing countries that follows a participatory cross-institutional and interdisciplinary approach.

Great emphasis is put on the interaction of participants’: Along with classic face-to-face lectures, a lot of group work, case studies and role-plays reveal creativity and make participants think in a holistic way. Technical exercises help participants to thoroughly understand the various applied technologies and provide them with the ability to design and implement ecosan projects themselves. Participants develop feasibility studies of real ecosan projects in an extended group exercise from scratch. The results are presented and discussed in the plenary and later often lead to the actual implementation through the participants’ organisations.

The course participants receive a full package of up to date learning to allow them to continue working with ecosan systems..



Figure 4: Besides classic face-to-face lectures, many group works, case studies and role-plays form part of the ESF ecosan courses. They reveal creativity and make participants think in a holistic way. (Left) Training course participants of the GTZ-supported Ecosan Service Foundation (Pune) during a field visit (middle). (Source:ESF)

The ESF ecosan training courses are meant to provide participants with the knowledge to meet the challenges of successfully implementing socially, economically and ecologically viable sanitation projects. After completing the course, various opportunities are open to them.

Figure 5: Overview of a set of open-source ecosan training courses for various target groups – all developed by the GTZ-ppp supported Ecosan Service Foundation in Pune

| Type of Course | Date | Location | Participants | No. of Part. | Client/Partners |
|--|-----------|---------------|---|--------------|--|
| Ecosan Expert Courses (2 weeks) | Mar. '07 | Nashik, India | Govt. Officials, NGOs, Students | 19 | German Agency for Technical Cooperation (GTZ), Germany |
| | Sept. '07 | Nashik, India | NGOs, Govt. Officials, Business Companies, Students | 19 | German Agency for Technical Cooperation (GTZ), Germany |
| | Jan. '08 | Nashik, India | Govt. Officials, NGOs, Educational Institutes, Business Companies | 16 | European Union (ASIA PRO ECO II Programme) |
| | May '08 | Nashik, India | Govt. Officials, NGOs, Educational Institutes, Business Companies | 42 | European Union (ASIA PRO ECO II Programme) |
| | Jan'09 | Pune, India | Govt. Officials, NGOs, Educational Institutes, Business Companies | | |
| Ecosan Basic Course (1 week) | Dec. '07 | Pune, India | Maldivian Water, Sanitation and Education Officials | 15 | WHO South-East Asia |
| Ecosan Training for Trainers of Public Health Inspectors (1 week) | Jan. '08 | Sri Lanka | Trainers of Public Health Inspectors | 30 | International Red Cross, Stockholm Environment Institute (SEI) & National Institute of Health Sciences |
| Ecosan Training of Trainers (2 weeks) | April '08 | Philippines | Govt. Officials, Public Health Officers, NGOs, Educational Institutes, Students | 30 | GTZ Philippines & Xavier University Cagayan de Oro City |
| Ecosan Training Course for Total Sanitation Campaign Officials (1 week) | April '08 | Pune, India | State Directors, Total Sanitation Campaign India | 11 | Government of India |
| | Aug. '08 | Pune, India | District Managers & Assistant State Directors, Total Sanitation Campaign India | 35 | Government of India |
| | Aug. '08 | Pune, India | District Managers & Assistant State Directors, Total Sanitation Campaign India | 35 | Government of India |
| E-learning Courses (1 week) | Dec. '07 | Worldwide | NGOs, Students, PhD Students | 23 | European Union (ASIA PRO ECO II Programme) |
| | Mar. '08 | South Asia | NGOs, Students, Private Individuals, Business Companies | 20 | European Union (ASIA PRO ECO II Programme) |
| | June '08 | South Asia | NGOs, Students, Private Individuals, Business Companies | 38 | European Union (ASIA PRO ECO II Programme) |

2.3 Sustainable sanitation projects in India

Many proven technical elements are available for sustainable sanitation systems and the number of pilot demonstration and research projects, as well as large scale applications, is continuously increasing. For example, in the last few years about 5.000 UDDTs (Urine Diversion Dehydration Toilets) have been built in India – many of them as show cases for how the new technology works and can be operated. Similarly a high number of CBO-run community toilets – often reusing biogas produced from wastewater – have been installed. Also over 200 institutions and small and medium scale enterprises have been equipped with ecologically friendly semi- or decentralised wastewater treatment and reuse systems.

These pilot research and demonstration projects do showcase innovative solutions in a variety of climatic, social, cultural, economic and geo-morphological contexts, and help in the development of a series of model solutions covering the whole range of sanitation needs.

However, given the broad variety of local framework conditions and the large number of open questions in this complex interdisciplinary field, there is still a great need to further develop technical and operational solutions and to enlarge the knowledge base with respect to public health, risk management, economics, logistics, material-flow-streams, socio-cultural and many other aspects. Hence, we urgently need innovative projects, to learn from them what works and what does not, and to be able to up-scale the success stories soon. The systematic integration and combination of proven centralised, semicentralised and decentralised sustainable sanitation solutions into the town/city development plans therefore needs to be backed by EIA (ecologic impact assessment) and cost-efficiency analysis at town/city level.

The present publication constitutes a means of providing some insight into Indo-German development cooperation by highlighting implemented projects for innovative sustainable sanitation systems which are the base for knowledge-management, networking and the development of an enabling context for sustainable sanitation solutions.



Figure 6: Proud of their ecosan sanitation system – Pupils of the Navsarjan school near Ahmedabad (Gujarat, India) (Source GTZ/ESF).

2.3.1 Sanitation is dignity – BMZ-GTZ-ecosan / ESF supported project at the Navsarjan boarding schools

One important partner in the Innovative Ecological Sanitation Network, India (IESNI) is the "Navsarjan Trust", which is dedicated to improving the living conditions of Dalits. Although laws have been made by the Government of India to ensure better working conditions, still many Dalits empty and clean latrines, and evacuate their content from the villages and cities, mostly unprotected, equipped merely with plaited baskets. According to the Navsarjan Trust the ecosan approach does not only have positive impacts on the hygienic situation but also the human dignity and working conditions, and ultimately the social status of the Dalits can be improved by it.

Project Box 2: Sanitation is dignity – ecosan project at Navsarjan schools, Gujarat

The Project

The "Navsarjan Trust", which is dedicated to improving the living conditions of Dalits, operates in over 1,000 villages in the state of Gujarat. Together with the BMZ-GTZ-ecosan programme, closed-loop oriented concepts are being implemented also in elementary schools and central vocational training institutes. The GTZ-ecosan programme contributes to spread ecologically, economically, and socially sustainable sanitation system worldwide on behalf of the BMZ (German Federal Ministry for Economic Cooperation and Development). In collaboration with the biggest association for water works in India (IWWA) and local partners like the Navsarjan Trust, it supports the Indian Ministry for Rural Development with the elaboration of strategies for nation-wide dissemination of sustainable sanitation concepts.

Impacts

In one of the GTZ-supported "Navsarjan Trust" schools' pupils have recently received the "Young Scientists" prize in the Ahmedabad school science fair for the model they built by them, which demonstrates the functional principles of their school's urine diversion toilets. After one year of storage in the dry climate of Gujarat, the faeces are converted into harmless, hygienic nutrient-rich material. This material is excellent to improve the fertility of the region's barren soils.



Figure 7: The school's sanitation block (far left), and from the back (left). Faeces are not flushed with water, but sprinkled with dry material, e.g. ash, over them (right). Hygiene education, such as hand washing is part of the scheme (middle). (Source GTZ/ESF)

The grey water from showers and wash basins contributes, after proper treatment, to irrigation of school garden and green spaces. This is of high value for the schools, as they are located in water-scarce areas where water is expensive and precious.

By examining the hygienic conditions, water management and the potential of closed-loop sanitation project, the pupils became real ecosan experts; Experts that India will soon be needed in large numbers.

2.3.2 Urban sustainable sanitation in a College near Mumbai, Maharashtra – supported by BMZ-GTZ-ecosan and ESF, Pune

As communities throughout the world approach the limits of their available resources, sustainable development has become an attractive option for conserving and extending available resources. Indian cities, like many of their post-colonial counterparts, are beset by immense environmental problems. As urbanization continues, these problems are escalating. To put sustainable sanitation projects in practice at universities, colleges and schools allows the approaches adopted to be tested during educational activities. This is of great importance as education has a clear role to play, both in acknowledging the paradigm shift in sanitation and in incorporating the interdisciplinary theme of innovative sustainable sanitation systems into teaching curricula. Education on reuse-oriented systems can enable the students to understand how sanitation systems can be hygienically safe, socially acceptable, economically feasible, environmentally sound and technically appropriate in an urban context. One such project implemented at a college near Mumbai allows the students to experience and to do research on their own productive sanitation system.

Project Box 3: Sustainable sanitation system at the AVM-college in Badlapur (near Mumbai)

Adarsh Vidya Mandir is one of the most famous educational institutions within Kulgaon Badlapur Municipal Council accommodating for 1300 students in morning and 1300 students in evening classes. In order to upgrade the sanitation situation in the school, the municipality came up with an idea to implement the complete ecological sanitation approach that not only meets the sanitation requirements of the pupils but also protects the environment and raises the awareness amongst the students educating them the importance of water and sanitation in promoting health and hygiene.

The existing school toilets were in poor condition and new toilet blocks for male and female students were constructed. The new toilet buildings have pour flush toilets. Water from the toilets (black water) and water from hand washing and other purposes (grey water) are jointly connected to the biogas settler where the waste water is treated through anaerobic treatment for the production of biogas.



Figure 8: Students of the Adarsh Vidya Mandir College, Badlapur (left); new toilet centre (middle); technical drawing of sanitation system of the college (right) Source: ESF

Urine is collected from the boy's toilet using waterless urinals. The black and grey water are initially drained to the "Biogas settler" where the waste water is subjected to anaerobic decomposition. The effluent is then drained to anaerobic baffle reactors for the further treatment of faecal sludge. The effluent from the anaerobic baffle reactors is then subjected to horizontal flow through the constructed wetland in order to further decrease the BOD (biological oxygen demand) of the waste water. The final effluent from the horizontal flow through the wetland is stored at the polishing pond and re-used for landscaping.

Re - use

- The collected urine from the waterless urinals is stored and is used for agriculture/gardening purpose within the school campus.
- The produced biogas is used either for cooking purpose or lightening purpose.
- The faecal sludge is used as compost in campus agriculture/gardening purpose.
- The final effluent which is stored in the polishing pond is used for irrigation.

2.3.3 Sustainable sanitation in the broader frame work of an eco-city approach – The BMZ-GTZ-ASEM-eco-city programme

Urban India today has to face several challenges triggered by an increasing population and consequent haphazard growth of cities and towns. The major problems in urban areas are related to land use conflicts, deteriorating environmental quality, pollution, pressure on natural resources, socio-economic issues including industry, trade & commerce, sanitation, health, slums & livelihood, issues related to water and energy and issues related to finances and revenues of the municipalities.

The socio-economic, living and sanitary conditions of the bulk of the urban populace are below standards and the provision of basic urban services very poor. Drainage and sewerage are inadequate and often faulty with sewage finding its way into the storm water drains or leaking into water lines. Thus sustainable management of resources and planned development in cities has become increasingly essential.

The overall control of the Eco-City Project rests with the Ministry of Environment and Forests, Government of India while the planning & coordination of the project is purview of the Central Pollution Control Board. GTZ plays a key role in providing technical support for ensuring high quality results and improved urban sustainability management and also supports project development while facilitating strategic alliances. The implementation of the project rests with the municipalities.

The Eco-City Project is targeted at bringing in visible environmental improvement through implementation of a set of identified projects. The focus of the project is pollution control, improvement of environmental quality, protection of environmental resources like rivers and lakes, improving sanitary conditions, improving the needed infrastructure and creating aesthetic environments in the chosen towns. The Eco-City Project is hoped to pave a way for transforming the identified project areas into places that are clean, orderly and sustainable.

The Eco-City Project has emphasis on custom made plans, designs and specifications that are harmonious with the town's profile while ensuring sustenance of the interventions. The project structure includes preparation of proposals/plans for the identified project areas, preparation of detailed project reports (DPRs) for the identified priority projects, documentation of "environmental indicators" and implementation of the identified projects.

The main focus of the project is on:

Environmental Quality: Decreasing the levels of air and water pollution. Conservation of natural resources, improved sanitation, waste management and reduced water-borne diseases are other important aspects.

Socio-economic Aspects: Improving the living conditions of the people will also help in improving tourism and increase the revenues for the municipalities.

Recycling: Reduction of wastes through segregation, recycling and reuse are important aspects aiming at improved municipal solid waste management system.

Urban Design: Design aspects of the urban area to include pedestrian friendly zones, clean and green open spaces and parks. Increase in the green canopy in the project areas.

Transportation: Creation of pedestrian pathways for safe access to sites such as temples and tourist spots; Development of parking facilities and traffic restrictions in congested areas; Service lanes to be properly integrated; and place provided for sewers, storm water drains and cables.

Urban Management: Improved urban management through introduction of urban sustainability management systems, including facilitating networking with European towns.

Project Box 4: Public toilets for the Eco-City Tirupati

The more central part of Tirupati is provided with an extensive underground sewer network. However, only about 30% of households and establishments are connected to the sewers. The rest discharge into septic tanks and soak pits or into the storm water drains. With the Eco-City project interventions, the Municipal Council has passed a resolution to enable connections of households and other establishment to the sewers.

Tirupati gets about 50,000 pilgrims everyday. Due to lack of adequate public conveniences, open defecation and urination is common. To start with, three toilets are proposed for construction at strategic points, in addition to the 3 existing toilets in the railway station, bus stand and the proposed one at the multi-storied parking facility. These 3 proposed toilets would be located near Koneru, near railway station and near the APSRTC bus stand.

Through the Consultants for GTZ (School of Planning & Architecture, JNTU, Hyderabad), designs have been developed for the public toilets, which have been approved by the DPR Expert Committee of CPCB and the Project Coordination Committee at Tirupati. The project is being implemented by the Tirupati Municipal Council and the Tirupati Urban Development Authority on a build-operate-transfer (BOT) basis. The aspects kept in mind while designing the toilet structures include: (1) Separate provisions for gents, ladies and physically handicapped; (2) Landscaping in front of the toilets; (3) Solar panning for the structures; (4) Granite stone exteriors to match with the character of the area; (5) Water recycling arrangements for gardening; (6) Provision for caretaker and tourists' luggage

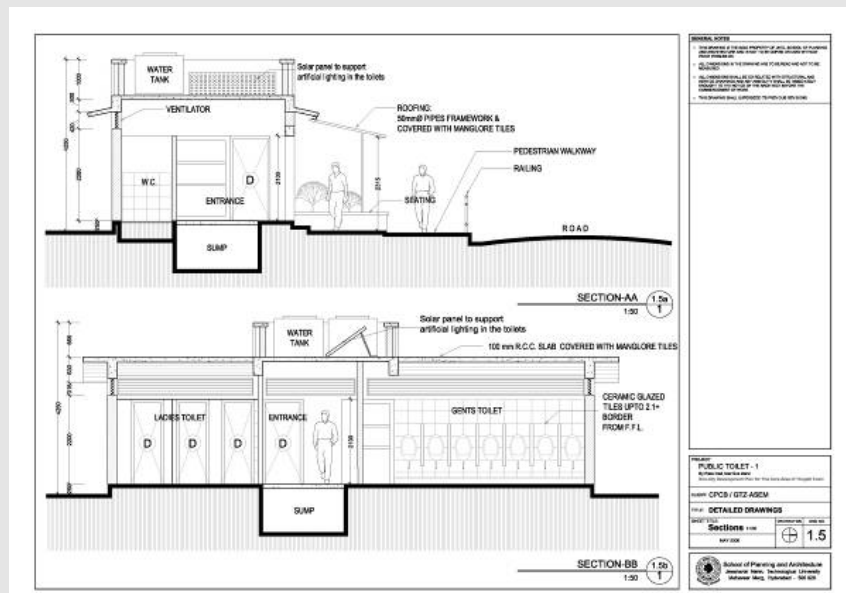


Figure 9: Sketch of the public toilet block proposed in the frame of the eco-city project in Tiruchipaly (Source:GTZ)

2.3.4 Slum sanitation as a business for the local Women Self Help Group (WSHG) – BORDA supported pay-for-use toilet in Bengaluru

Addressing aspects of dignity and gender issues in sanitation means having a closer look at social relationships, to see the different roles of community members and the complicated structure between different parts of the society and between women and men, girls and boys with regard to decision making, choice and manner of use of technology, hygiene, food security, financial security, crop production and health issues. Access to good sanitation facilities is cause of concern especially for those living in the slums as shrinking urban spaces make defecation a difficult task. Most of them usually live without proper toilet facilities and it is the women who suffer the most.

Participation does not mean merely inviting the men from all types of households to come to a meeting and vote on toilet designs, it requires deliberate and skilled facilitation to elicit this same information from women and the social or ethnic classes who are given the “dirty work” in any particular society.

Each group of the community has critical knowledge about the workings of the system, but they are frequently ignored as key stakeholders.

The public toilet project in Ulalu (Bengaluru) has been developed together with a local NGO and a local WSHG following BORDA's Community Based Sanitation (CBS) approach which includes multi-stakeholder involvement for all implementation steps – right from acquiring land, getting consensus on design, construction and operation and maintenance of the system. It is contributing to the income of several workers, runs commercially since several years, has improved the living conditions and dignity for the whole community, and reuses biogas produced from wastewater. Over 50 CBS - Decentralised wastewater treatment system (DEWATS) projects have been implemented in different parts of the country.

Project Box 5: Sustainable sanitation makes WSHG-public toilet commercial (Ulalu, Bengaluru)

Ulalu Upanagara is a peri-urban slum settlement of evicted slum dwellers, located south west of Bengaluru, India. This settlement of about 17.000 people belonged to different ethnic groups who had no basic amenities and the people defecate in the open. In 2003 BORDA took up the initiative to implement a Community Based Sanitation (CBS) programme and serve a cluster of 150 households, with investment costs of INR 3.000/cap. The main aim of this project was to provide the people with proper sanitation facilities and to improve the hygienic and environmental conditions of the surroundings with appropriate waste water management. This project has been conducted with complete involvement of the community and local government.

The CBS facilities with the localised treatment plant were constructed at 2 locations: one close to a bus stand and the second close to a school. Both the CBS facilities had a similar design comprising of 22 toilets, 2 bathrooms, 12 laundries and urinals. The Decentralized Wastewater Treatment System (DEWATS) installed under the building takes care of the liquid waste generated at the facilities. It consists of several components: A fixed dome tunnel shaped Biogas settler is installed that stores the biogas generated due to the digestion of settled organic particles under anaerobic conditions. Approximately 2 to 3 m³/day of biogas is generated from each facility. A 12 chambered baffle reactor ensures anaerobic degradation of suspended and dissolved solids by mixing fresh wastewater with an activated sludge blanket while a planted gravel filter serves as tertiary treatment unit where aerobic degradation of dissolved organics takes place. Within a futuristic ecosan vision, one unit was equipped with a collection tank to allow for future use of treated wastewater in small scale peri-urban agriculture. After 5 years this unit is out of use, as due to the unexpected fast urbanisation the land foreseen for urban agriculture is no more available.

The wastewater treatment plant is operated and maintained by the trained members of the local community based organization. A regular schedule is followed for maintenance, like periodical check of sewer line systems, removal of sludge in settler and in baffle reactor. In the planted gravel filter regular harvesting of plants is done and the filter media is washed once in five years.

The "pay-and-use" system meets the demand of the community and is an economically viable income-generating activity for the Woman-Self-Help-Group (WSHG) running the facilities. The user fees of an average of 600 people covers the operation and maintenance (O&M) costs of INR 50/cap/month and provides for savings of INR 8.000/month. The transformation of the slum of Ulalu into a peri-urban low-income settlement has also increased the number of individual toilets, often also shared with the neighbours. Therefore, the number of users from the community has gone down between 2003 and 2008 and use by transit population from the near-by bus station has increased.



Figure 10: Biogas stoves used for heating of bathing water (left) Construction of the Community based sanitation facility with Biogas settler, baffled reactor, planted gravel filter and the collection tank (middle) Leaders of the WSHG (Women-Self-Help-Group) running the sanitation complex (right) (source BORDA)

2.3.5 Sustainable sanitation provides fertiliser, irrigation water and biogas – BORDA supported sanitation project in Karnataka

Home gardens, allotments and community gardens offer great potential for improving livelihoods through reuse oriented sanitation systems that can be self-sustaining for the beneficiary, using water (e.g. from grey water, or from adequately treated wastewater) for irrigation and nutrients (from composted sludge, or urine-diverting systems) as fertiliser and soil conditioner. In the Philippines allotment gardens have been implemented, which use as fertiliser composted organic household wastes from integrated waste management (Universität Freiburg 2004; Holmer et al. 2003) and have been combined with ecosan systems for the reuse of human excreta (PUVeP 2005; GTZ-ecosan newsletter 2005-18). "Organoponics", a system similar to hydroponics has been promoted in Mexico (Sawyer, Arroyo and Delmaire 2003). Friends of Camphill, a trust in India, uses biogas and irrigation water from its reuse oriented sanitation system (DEWATS) for local food production and biogas from the system for cooking.

BORDA with its Indian Network Partner the Consortium for DEWATS Dissemination Society disseminates proven sanitation solutions. More than 300 systems have been installed for different sectors in India.

Project Box 6: Productive sanitation system meets demand of Camphill Trust (Karnataka)

'Friends of Camphill', a trust in India, supports a home for the mentally challenged people about 19 km from Bengaluru. The home accommodates approximately 40 to 70 inmates and workers together. To address their social, medical, psychological and occupational needs, a self sustaining sanitation system for the management of domestic wastewater was conceptualised. The system provides safe treatment of wastewater generated from domestic sources and generates biogas for cooking, water for gardening, and an option to produce compost from sludge from the biogas reactor.

The treatment system consists of 4 parts: Biogas settler, baffled reactor, planted gravel filter and the collection pond. The wastewater streams from the toilets, bathrooms, laundry and kitchen are channelled from different residential blocks and collected in a common place near the treatment system. The grease traps at the source provides pre-treatment to retain oil and grease by floatation. A fixed dome type of Biogas settler is installed that stores the biogas produced (approximately 2 to 4 m³/day) due to the digestion of settled organic particles under anaerobic conditions. The baffle reactor ensures anaerobic degradation of suspended and dissolved solids by mixing fresh wastewater with an activated sludge blanket while a planted gravel filter is used as tertiary treatment unit where aerobic and facultative degradation of dissolved organics occur. The collection pond is used to store the treated water.



Figure 11: Surroundings of Camphill Trust building do allow reuse of treated water and produced fertiliser (left) Biogas is used for cooking (R) Biogas plant with sludge drying beds (L) (Source BORDA)

The wastewater treatment plant and the conveyance system is operated and maintained by a trained gardener. A regular schedule is followed for maintenance, like removal of sludge, once a year from the settler and once every three years in baffle reactor. The filter media in the planted gravel filter is washed once in five years. The system is designed under the DEWATS approach, which combines a series of elements for wastewater management according to the local frame conditions.

Re-Use

- The biogas is used as a cooking fuel 3-5 hours/day
- The treated water is used for gardening
- The sludge extracted once every two years only, is being applied as fertilizer to the vegetable fields

2.3.6 Sanitation in Rajasthan in the “Apni Yojna (Our Project)” – supported by KfW Development Bank

A sector publication on Water (BMZ 2006) developed by the German Federal Ministry for Economic Collaboration and Development (BMZ) underlines: No water supply project in German development cooperation should be undertaken without looking at the same time carefully on the sanitation situation, aiming to best combine water and sanitation activities. The Indo-German project undertaken in Rajasthan and described below, gives an example how sanitation can be incorporated in a project concentrating initially on water supply and sector reform activities.

Project Box 7: Participation is key – this is one result of a KfW supported sanitation project in Rajasthan

The Project “Apni Yojna” (Our Project)

In the semi-arid region of the project in northeast Rajasthan live about one million people. There the pollution level in potable water frequently exceeds the benchmarks recommended by the World Health Organisation, which sometimes leads to serious illnesses.

Since 15 years the KfW Development Bank on behalf of the German Government supports rural water and basic sanitation provision in the region: 360 villages have been connected to regional distribution systems that extract the water from the Indira Gandhi Canal. This region has therefore been one of the first inland areas in India to have running water round the clock. The people cherish the comfort: 95% pay the water fees.

As the KfW Development Bank undertook the project in the 1990s, only 9% of the households had latrines. In the beginning the villagers were sceptic, they feared odour problems and water squander. To foster acceptance, “pilot latrines” were built and with the help of non-governmental organisations water committees were founded. Their tasks include equitable distribution of water, collection of fees and making sure latrines are kept clean. They developed a combined model of simple pour-flush latrine and a separate wash room. Such a facility with permanent walls, roof and doors costs about 135 Euro. They became so popular in the meantime, that only 20% still needs to be subsidised, whereas originally 60% was subsidised. About 30,000 latrines and 95 sanitation facilities for schools have been financed until 2007.



Figure 12: A combined model of simple pour-flush latrine and a separate wash room **was** jointly developed with the target groups in a KfW supported sanitation project in Rajasthan. (Source: KfW)

Impacts

More and more people construct their latrines independently from the project. Nowadays, 55 % of the households have their own private toilets. One study pointed out that the participation of the local villagers was crucial for the project’s success. Above all women and children have become aware of the significance of good hygiene, and they have been involved in the decision-making process: the women decided where toilets and wash rooms were to be located in order to be able to wash themselves undisturbed. The willingness to change **their own** behaviour is as high as in no other rural sanitation programme in India. The Indian government supports the behavioural change and creates additional incentives. As soon as a village achieves that “total sanitation” and each inhabitant has access to a toilet, the locality is awarded with a certificate from the Indian president. (Eli)

2.3.7 Contributing to a city-wide sustainable sanitation concept for Madurai (Tamil Nadu) – a CIM supported activity

The CIM (Centre for International Migration and Development) is a joint operation of the GTZ and the German Federal Employment Agency (BA). The Integrated Experts Programme places qualified European specialists into local institutions in developing countries. About 800 European managers and technical experts are currently working through the CIM Integrated Experts Programme in roughly 75 countries throughout the world. Applicants should have several years of professional experience in the respective field of specialisation. In India, several Integrated Experts are actively contributing to sustainable sanitation provision.

The example below describes one activity of an Integrated Expert employed by the Development of Humane Action (DHAN) Foundation, a Madurai based NGO working in 11 states. DHAN Foundation, supported through the CIM expert, is working on contributing to the development of a city-wide sustainable sanitation concept for Madurai through the application of innovative, reuse-oriented approaches. The tasks of the CIM Integrated Expert are to establish a respective network, design and construct pilot systems, and establish necessary internal structures through capacity building activities. As DHAN Foundation feels the need for integrating (semi-)decentralised treatment technologies into Madurai's sanitation management, a respective concept is prepared and presented to the local government in order to start pilot activities.

Project Box 8: Developing a city-wide sustainable sanitation concept for Madurai (T.N.)

Madurai city is the third largest city in the State of Tamil Nadu, with a population of about one million within the Municipal Corporation limits. Like in most Indian metropolitan areas, the wastewater management is currently insufficient and inadequate. Many wards within Corporation area are currently not or only partly covered with underground drainage. Due to insufficient wastewater disposal infrastructure, an immense quantity of sewage flows through open channels and rainwater drains into Vaigai River and rainwater harvesting structures. Due to capacity constraints of the two existing wastewater treatment systems, less than 50% of the collected wastewater is routed from the two main pumping stations towards treatment facilities. The overflow is directly routed into open water bodies. But even the wastewater which is pumped to the existing stabilisation ponds is not properly treated as the systems are inadequate, overcharged, and malfunctioning.

Madurai Municipal Corporation is aware of the shortcomings and is working on modernising and augmenting the existing drainage system and providing adequate centralised treatment. However, planned and already started improvements do not solve Madurai's sanitation problem entirely. Although the scheme aims towards universal ward coverage with underground drainage within Corporation areas, it is not scheduled to cover the complete population. Another shortcoming for Madurai as an urban agglomeration is, that scheduled improvements are restricted to Municipal Corporation areas. Urban settlements located outside Corporation limits are omitted.

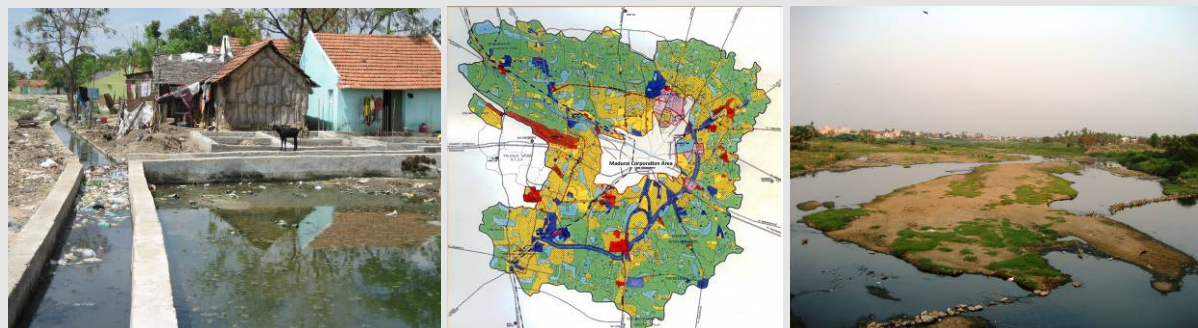


Figure 13: Rainwater drains used for blackwater disposal (l), Madurai Urban Agglomeration with Municipal Corporation limits (m), Vaigai River (r) (Source: DHAN Foundation)

For omitted areas and residents, (semi-)decentralised wastewater treatment offers a cost effective, environmentally sound, fair, efficient, and sustainable answer. Systems, designed following the

example of. the DEWATS or the ecosan approach, provide a number of advantages besides the fact that they are easily applicable in areas where centralised treatment is not feasible for technical, political, or economical reasons.

Appropriate areas for decentralised systems are settlements in the periphery, new settlement, villages in the outskirts, areas with low population density, provisional settlements (temporary solution), schools, training centres, hospitals, hostels, and all areas which are not connected or which are not scheduled to be connected to a centralised system. Hence, the coexistence of conventional centralised treatment systems for core areas, combined with decentralised systems for omitted locations, is the most beneficial solution.

In order to improve the living conditions of dwellers throughout Madurai's urban agglomeration, DHAN Foundation and the CIM Integrated Expert are contributing to the development of a city-wide sustainable sanitation concept, and are focussing their work on those parts of the city and population that will not be reached easily by centralised large sewer systems. Upcoming initiatives include identifying a suitable location for a pilot system in collaboration with the Municipal Corporation, designing and building the system in collaboration with the Bengaluru based Consortium for DEWATS Dissemination, training users and maintenance staff, and monitoring the performance of the system. This first showcase system in Madurai should act as a door-opener for upcoming projects.

Source: "Alternative Paradigms in Sanitation Management - Decentralised Wastewater Treatment, a Case Study: Madurai, India". Götzenberger, Jens. DHAN Foundation. Madurai, India, 2008

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3 The way forward

The Total Sanitation Campaign (TSC) of the Government of India is a success story and achieved thousands of ODF (Open Defecation Free) villages in the last few years. For the urban context a national urban sanitation policy has been launched in November 2008 to accelerate sanitation provision in cities.

Millions of people in India need to be provided with sustainable sanitation facilities in the years to come to reach the MDGs – and millions of toilets and related sanitation systems will be built in the near future.

It is our joint concern in the Indo-German Development Cooperation that the money spent for this, is well invested for the country – thus it should be put in to sustainable projects. We need to learn from existing projects what is feasible under which frame conditions on the long term, what is economically, and ecologically viable and socially acceptable. To quickly up-scale these examples without compromising sustainability is the core of the task in front of us.

This publication has therefore shown some examples of sustainable sanitation projects undertaken in the Indo-German Development Cooperation that should stimulate accelerated implementation of innovative and sustainable solutions. A first wave of good examples is now available from peri-urban and urban contexts. There is a clear demand for knowledge centres and living examples to spread the new knowledge and technologies.

The need of the hour is a joint activity for a large scale capacity development initiative for sustainable sanitation implementation. The partners in the Indo-German Development Cooperation, plus the Indian and International Networks (e.g. SuSanA) need to focus on supporting of the up-scaling of good examples with a large scale capacity development initiative – both needed for enabling sustainable sanitation provision throughout India.

4 Further Reading

- Anschütz, J, Jeroen, I & Scheinberg, A 2004, *Putting Integrated Sustainable Waste Management to Practice - Using the ISWM Assessment Methodology - ISWM Methodology as Applied in the UWEP Plus Programme (2001-2003)*, WASTE, Gouda, The Netherlands, viewed 16 December 2008, <[http://www.waste.nl/redirect/content/download/561/4346/file/ISWM ass eng screen.pdf](http://www.waste.nl/redirect/content/download/561/4346/file/ISWM_ass_eng_screen.pdf)>.
- Belevi, H 2002, 'Material flow analysis as a strategic planning tool for regional waste water and solid waste management', paper presented at the GTZ /BMZ & ATV-DVWK workshop 'Globale Zukunft: Kreislaufwirtschaftskonzepte im kommunalen Abwasser- und Fäkalienmanagement' during the IFAT, Munich, Germany, 13-15 May, viewed 15 December 2008, <http://www.nccr-north-south.unibe.ch/publications/Infosystem/Online%20Dokumente/Upload/Belevi_Material%20flow%20analysis_2002.pdf>.
- Black, M & Fawcett, B 2008, *The last taboo - opening the door on the global sanitation crisis*, Earthscan.
- Black, M & Rupert, T 2005, *Water, a matter of life and health – water supply and sanitation in village India*, Oxford University Press, Oxford, UK.
- BMZ (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung) 2006, *Sektorkonzept Wasser*, Berlin, Germany, viewed 16 December 2008, <<http://www.bmz.de/de/service/infothek/fach/konzepte/Konzepte143.pdf>>.
- Bracken, P, Kvarnström, E, Ysunza, A, Kärrman, E, Finnson, A & Saywell, D 2005, 'Making sustainable choices – the development and use of sustainability oriented criteria in sanitary decision making', *Third International Conference on Ecological Sanitation (EcoSan): proceedings*, Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa, viewed 15 December 2008, <<http://www.GTZ.de/de/dokumente/en-criteria-for-decision-making-in-sanitation-sustainability-2005.pdf>>.
- Calvert, P 2004, *Ecological solutions to flush toilet failures*, EcoSolutions, Pickering, UK.
- Cotton, A & Tayler, K 2000, *Services for the urban poor - guidance for policymakers, planners and engineers*, WEDC (Water, Engineering and Development Centre), Loughborough University, Loughborough, UK.
- Eawag (Swiss Federal Institute of Aquatic Science and Technology) 2005, *Household-centred environmental sanitation, implementing the Bellagio principles in urban environmental sanitation – provisional guideline for decision makers*, Dübendorf, Switzerland, viewed 15 December 2008, <<http://www.wsscc.org/pdf/publication/hces.pdf>>.
- FAO (Food and Agriculture Organization of the United Nations) 1999, 'Issues in urban agriculture - Studies suggest that up to two-thirds of city and peri-urban households are involved in farming', *Spotlight*, FAO, Rome, Italy, viewed 16 December 2008, <<http://www.fao.org/ag/magazine/9901sp2.htm>>.
- Faruqui, NI, Niang, S & Redwood, M 2004, 'Chapter 10 - Untreated Wastewater Use in Market Gardens: A Case Study of Dakar, Senegal', in CA Scott, NI Faruqui & L Raschid-Sally (eds), *Wastewater Use in Irrigated Agriculture - Coordinating the Livelihood and Environmental Realities*, CAB International, Wallingford, UK, viewed 16 December 2008, <http://www.idrc.ca/en/ev-31595-201-1-DO_TOPIC.html>.
- Fong, MS, Wakeman, W & Bhushan, A 1996, 'Toolkit on Gender in Water and Sanitation', *Gender Toolkit Series No. 2*, Gender Analysis and Policy, Poverty and Social Policy Department, UNDP-World Bank Water and Sanitation Program (WSP), TWUWS, The World Bank, Washington DC, USA, viewed 16 December 2008, <<http://siteresources.worldbank.org/INTGENDER/Resources/toolkit.pdf>>.
- Forster, D, Schertenleib, R & Belevi, H 2004, 'Linking urban agriculture and environmental sanitation', *ecosan - closing the loop - Proceedings of the 2nd international symposium on ecological sanitation, incorporating the 1st IWA specialist group conference on sustainable sanitation, 7th-11th April 2003, Lübeck, Germany*, eds C Werner, V Avendaño, S Demsat, I Eicher, L Hernandez, C Jung, S Kraus, I Lacayo, K Neupane, A Rabiega & M Wafler, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/de/dokumente/en-ecosan-symposium-luebeck-session-h-2004.pdf>>.
- Goethert, R & Hamdi, N 1997, *Action planning for cities - A guide to community practice*, John Wiley & Sons, Hoboken, USA.
- GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) 2003, *10 Recommendations for Action from the Luebeck Symposium on ecological sanitation, April 2003*, GTZ, Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/de/dokumente/en-ecosan-recommendations-for-action-2003.pdf>>.
- GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) 2005a, *Project data sheets for ecosan*, GTZ, Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/en/themen/umwelt-infrastruktur/wasser/9399.htm>>.
- GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) 2005b, *Technical data sheets for ecosan*, GTZ, Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/en/themen/umwelt-infrastruktur/wasser/9397.htm>>.
- GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) 2005c, 'Urine separation and reuse project at the main building of GTZ GmbH Eschborn, Germany', *Data sheets for ecosan projects*, GTZ, Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/de/dokumente/en-ecosan-pds-016-germany-GTZ-eschborn-2005.pdf>>.

- GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) 2008, *ecosan newsletter No 27*, GTZ, Eschborn, Germany, viewed 16 December 2008, <<http://www.gtz.de/en/themen/umwelt-infrastruktur/wasser/9403.htm>>.
- Haller, L, Hutton, G & Bartram, J 2007, 'Estimating the costs and health benefits of water and sanitation improvements at global level', *Journal of Water and Health*, vol. 5, no. 4, pp. 467–480.
- Hamdi, N & Majale, M 2005, *Partnerships in urban planning - A guide for municipalities*, Practical Action Publishing, Warwickshire, UK.
- Hellström, D, Jeppsson, U & Kärrman, E 2000, 'A framework for systems analysis of sustainable urban water management', *Environmental Impact Assessment Review*, vol. 20, no. 3, pp. 311-322.
- Holmer, RJ, Clavejo, MT, Dongus, S & Drescher, A 2003, 'Allotment Gardens for Philippine Cities', *Urban Agriculture Magazine*, no. 11, pp. 29-31, Resource centre on urban agriculture and forestry (RUAFA), Leusden, The Netherlands, viewed 16 December 2008, <http://www.puvep.com/publications/29_phil.pdf>.
- IFS (International Foundation for Science) 2005, *Strengthening Capacity for Research on Sustainable Sanitation and Grey-Water Reuse in Developing Countries*, Stockholm, Sweden, viewed 16 December 2008, <http://www.ifs.se/Programme/ifs_sida_specialcall.asp>.
- IWA (International Water Association) 2005, *Sanitation 21 - Simple approaches to complex sanitation - A draft framework for analysis*, IWA, London, UK, viewed 16 December 2008, <<http://www.iwahq.org/uploads/iwa%20hq/website%20files/task%20forces/sanitation%2021/Sanitation21v2.pdf>>.
- Johansson, M, Jönsson, H, Höglund, C, Richert Stintzing, A & Rodhe, L 2000, *Urine Separation – Closing the nutrient cycle*, Stockholm Water Company, Stockholm, Sweden.
- Johansson, M & Kvarnström, E 2005, 'A Review of Sanitation Regulatory Frameworks', *EcoSanRes Publications Series*, Stockholm Environment Institute (SEI), Stockholm, Sweden, viewed 16 December 2008, <http://www.ecosanres.org/pdf_files/ESR_publications_2005/ESR_2005-1.pdf>.
- Kalbermatten, JM, Middleton, R & Schertenleib, R 1999, *Household-Centred Environmental Sanitation*, Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dübendorf, Switzerland, viewed 16 December 2008, <http://www.sandec.ch/EnvironmentalSanitation/Documents/Paper_Description_HCES_July99.pdf>.
- Kvarnström, E & Petersens, E 2004, 'Open planning of sanitation systems', *EcoSanRes Publications Series*, Stockholm Environment Institute (SEI), Stockholm, Sweden, viewed 16 December 2008, <http://www.ecosanres.org/pdf_files/ESR_Publications_2004/ESR3web.pdf>.
- Lange, J & Otterpohl, R 2000, *Abwasser - Handbuch zu einer zukunftsfähigen Wasserwirtschaft*, 2nd edn, Mallbeton Verlag, Donaueschingen-Pföhren, Germany.
- Larsen, TA & Gujer, W 1996, 'Separate management of anthropogenic nutrient solutions (human urine)', *Water Science and Technology*, vol. 34, no. 3-4, pp. 87-94.
- Larsen, TA & Gujer, W 1997, 'The concept of sustainable water management', *Water Science and Technology*, vol. 35, no. 9, pp. 3-10.
- Larsen, TA & Lienert, J 2003, 'Societal Implications of Re-engineering the Toilet', *Sustainability in the water sector: IWA leading edge conference series: Venice, Italy, November 2002*, IWA Publishing, London, UK.
- Lehn, H 2004, 'Sustainable sanitation systems – dissolving the antagonism between urban comfort and hygienic pollution of urban environs', *International summer academy on technology studies - Urban infrastructure in transition: what can we learn from history?*, ed. P Wilding, Graz University of Technology, Graz, Austria, viewed 16 December 2008, <http://www.ifz.tugraz.at/index_en.php/filemanager/download/307/Lehn_SA%202004.pdf>.
- Lennartsson, M, Kvarnström, E, Lundberg, T, Buenfil, J & Sawyer, R 2006, *Evaluation in sanitation – Review of three illustrative examples*, Stockholm, Sweden.
- Lens, P, Zeeman, G & Lettinga, G (eds) 2001, *Decentralised sanitation and reuse - Concepts, systems and implementations*, IWA Publishing, London, UK.
- Lettinga, G 1996, 'Sustainable integrated biological wastewater treatment', *Water Science and Technology*, vol. 33, no. 3, pp. 85-98.
- Mamit, JD, Sawal, P, Larsen, I & Huong, TH 2005, *Integrating conventional and ecological sanitation in urban sanitation for the future*, Manuscript from the Norwegian ecocycle conference April 26-27, Norway.
- Mara, D & Alabaster, G 2008, 'A new paradigm for low-cost urban water supplies and sanitation in developing countries', *Water Policy*, vol. 10, no. 2, pp. 119-129.
- Mukherjee, N & van Wijk, C (eds) 2002, *Sustainability planning and monitoring in community water supply and sanitation - A guide on the methodology for participatory assessment (MPA) for community-driven development programs*, UNDP-World Bank Water and Sanitation Program (WSP), Washington DC, USA, viewed 16 December 2008, <http://www-wds.worldbank.org/external/default/WDSContentServer/WDS/IB/2004/12/23/000090341_20041223093826/Rendered/PDF/309590PAPER0Sustainability0planning02003.pdf>.
- Murray, A 2008, *Toolkit for the 21st-century urban sanitation planner*, Sustainable products and solutions program, University of California, Berkeley, USA.
- Narain, S 2004, 'Why the flush toilet is ecologically mindless and why we need a paradigm shift in sewage technology', *ecosan - closing the loop - Proceedings of the 2nd international symposium on ecological sanitation, incorporating the 1st IWA specialist group conference on sustainable sanitation, 7th-11th April 2003, Lübeck, Germany*, eds C Werner, V Avendaño, S Demsat, I Eicher, L Hernandez, C Jung, S Kraus, I Lacayo, K Neupane, A Rabięga & M Wafler, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/de/dokumente/en-ecosan-symposium-luebeck-opening-session-2004.pdf>>.

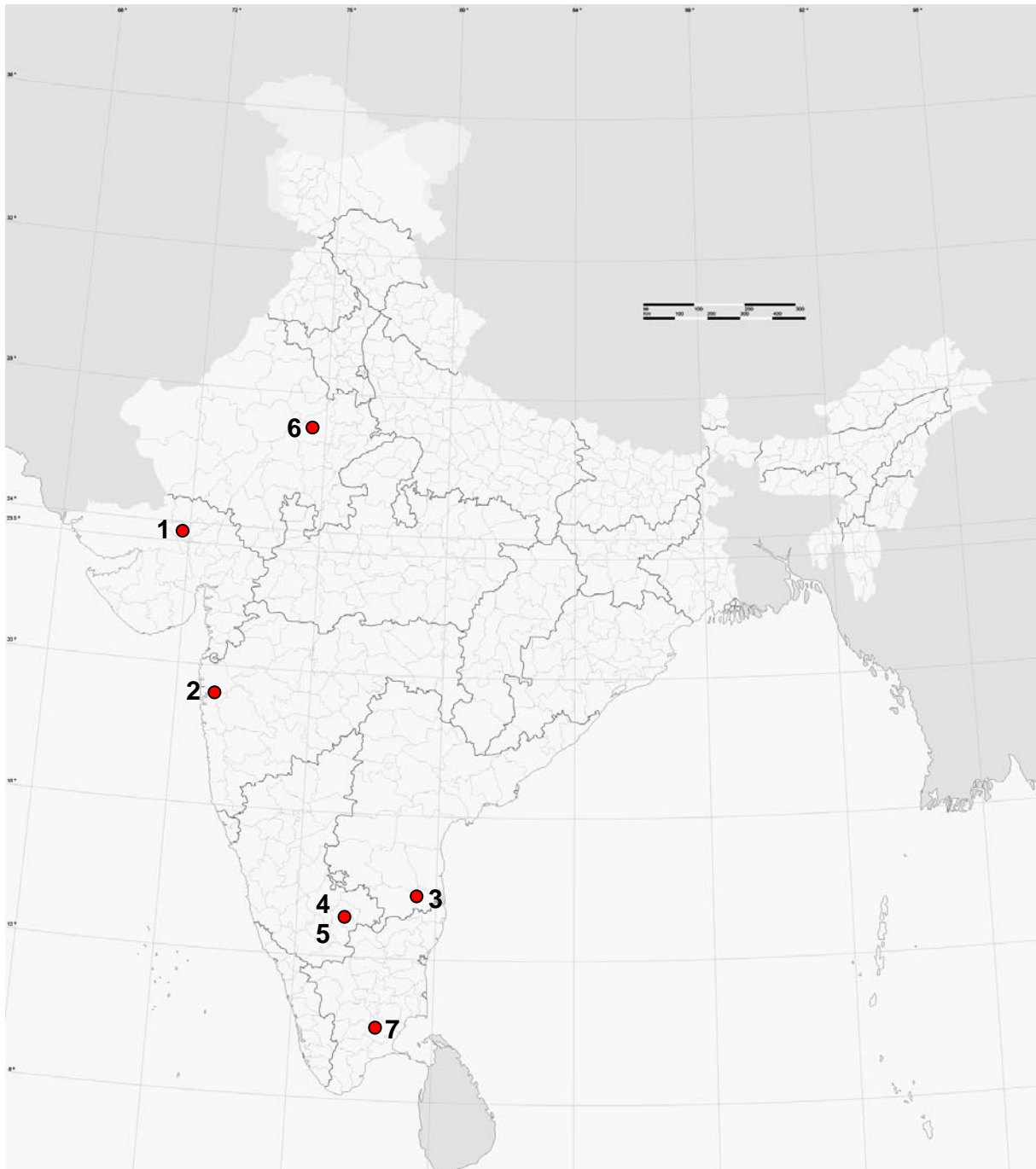
- NETSSAF (Network for the development of Sustainable approaches for large scale implementation of Sanitation in Africa) 2006: *Criteria for the evaluation and classification of conventional and innovative low cost sanitation technologies*, NETSSAF, viewed 16 December 2008, <http://www.netssaf.net/typo3conf/ext/naw_secured/secure.php?u=0&file=fileadmin/Files/Documents/Secured_Area/6_Final_Deliverables/NETSSAF_D04_01.pdf&t=1229611436&hash=31429a9ab03afd528cf8d6c4e3046370>.
- Nugent, R & Drescher, A 2000, *Urban and peri-urban agriculture (UPA) on the policy agenda: virtual conference and information market*, A joint venture of the FAO Interdepartmental Working Group (IDWG), Food for the Cities (FFC) and the Resource Center for Urban Agriculture and Forest (RUA/ETC), Leusden, The Netherlands.
- Otterpohl, R 2005, 'A shift to resources management sanitation', *WATER 21*, April 2005, IWA Publishing, London, UK, viewed 16 December 2008, <http://www.tuhh.de/susan/downloads/water21ecosan_discussion.pdf>.
- Panesar, A & Lange, J 2004, 'Innovative sanitation concept shows way towards sustainable urban development. Experiences from the model project "Wohnen & Arbeiten" in Freiburg, Germany', *ecosan - closing the loop - Proceedings of the 2nd international symposium on ecological sanitation, incorporating the 1st IWA specialist group conference on sustainable sanitation, 7th-11th April 2003, Lübeck, Germany*, eds C Werner, V Avendaño, S Demsat, I Eicher, L Hernandez, C Jung, S Kraus, I Lacayo, K Neupane, A Rabiega & M Wafler, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/dokumente/en-ecosan-symposium-luebeck-session-i-2004.pdf>>.
- PEP (Poverty-Environment Partnership) 2006, Linking poverty reduction and water management, viewed 16 December 2008, <http://www.who.int/entity/water_sanitation_health/resources/povertyreduc2.pdf>.
- Phillips, D, Williams, K et al. 1999, *Literature review on peri-urban natural resource conceptualisation and management approaches*, Final technical report for project R6949, University of Nottingham, Nottingham, UK, viewed 16 December 2008, <<http://www.research4development.info/PDF/Outputs/NatResSys/R6949FTR.pdf>>.
- PUVeP 2005, *Allotment gardens*, Periurban Vegetable Project (PUVeP) of the Xavier University in Cagayan de Oro, Mindanao, Philippines, viewed 16 December 2008, <<http://puvep.xu.edu.ph/ag/ag.htm>>.
- Roberts, M 1974, *An introduction to town planning techniques*, Hutchinson, London, UK.
- Rosemarin, A, Ekane, N, Caldwell, I, Kvarnström, E, McConville, J, Ruben, C and Fogde, M 2008: *Pathways for Sustainable Sanitation - Achieving the Millennium Development Goals*, IWA Publishing, London, UK.
- Saidi-Sharouze, M 1994, *Ouagadougou and Kumasi sanitation projects: a comparative case study*, UNDP-World Bank Water and Sanitation Program (WSP), West Africa regional water and sanitation group, Abidjan, Cote D'Ivoire.
- Sandec 2008, *Chang'ombe Status Assessment Report*, Dodoma, Tanzania.
- Schönning, C & Stenström, TA 2004, 'Guidelines on the safe use of urine and faeces in ecological sanitation systems', *EcoSanRes Publications Series*, Stockholm Environment Institute (SEI), Stockholm, Sweden, viewed 16 December 2008, <<http://www.ecosanres.org/PDF%20files/ESR%20Publications%202004/ESR1web.pdf>>.
- SEI (Stockholm Environment Institute) 2005, *Sustainable Pathways to Attain the MDGs: Addressing the Key Role of Water, Energy and Sanitation*, SEI, Stockholm, Sweden, viewed 16 December 2008, <<http://www.ecosanres.org/PDF%20files/MDGRep/SustMDG31Auglowres.pdf>>.
- Shaeffer, JR & Stevens, LA 1983, *Future Water*, William Morrow and Co., New York, USA.
- SIWI (Stockholm International Water Institute) et al. 2008, 'Monitoring drinking water supply and sanitation: Moving beyond 2015, preparing the next generation indicators'. Stockholm World Water Week 2008 Seminar, Stockholm, Sweden, 17-23 August.
- Smit, J, Ratta, A & Nasr, J 1996, 'Urban agriculture: food, jobs, and sustainable cities', *Publication Series for Habitat II*, vol. 1, United Nations Development Programme (UNDP), New York, USA.
- SuSanA (Sustainable Sanitation Alliance) 2007a, *Joint road map – sustainable sanitation related activities of the Sustainable Sanitation Alliance (SuSanA) for the UN International Year of Sanitation 2008*, SuSanA, Eschborn, Germany, viewed 16 December 2008, <<http://www2.GTZ.de/Dokumente/oe44/ecosan/nl/en-susana-joint-road-map-iyos-2008.pdf>>.
- SuSanA (Sustainable Sanitation Alliance) 2007b, *Vision statement*, SuSanA, Eschborn, Germany, viewed 16 December 2008, <<http://www.susana.org/index.php/lang-en/vision>>.
- SuSanA (Sustainable Sanitation Alliance) 2008a, 'Ecological sanitation and reuse in allotment gardens – South-East Asia, Philippines, Cagayan de Oro City – focal areas: food security, urban agriculture', draft, *Case studies of sustainable sanitation projects*, SuSanA, Eschborn, Germany, viewed 16 December 2008, <<http://www.susana.org/images/documents/06-case-studies/en-susana-case-study-cagayan-de-oro-philippines-2008-02-12.pdf>>.
- SuSanA (Sustainable Sanitation Alliance) 2008b, 'Planning for sustainable sanitation', Version 1.1, *SuSanA – fact sheet*, SuSanA working group 06 - sustainable sanitation for cities and planning, Eschborn, Germany, viewed 16 December 2008, <<http://www.susana.org/images/documents/05-working-groups/wg06/final-docs/en-susana-factsheet-WG06-planning-version-1.1.pdf>>.
- SuSanA (Sustainable Sanitation Alliance) [in prep.], 'Criteria for sustainable sanitation in cities', Draft version available by end of 2008, *SuSanA – fact sheet*, SuSanA working group 06 - sustainable sanitation for cities and planning, Eschborn, Germany.
- Taylor, K, Parkinson, J & Colin, J 2003, *Urban Sanitation: A Guide to Strategic Planning*, Intermediate Technology Publications, Warwickshire, UK.
- Taylor, K 2008, 'Urban Sanitation - lessons from experience', *Waterlines*, vol. 27, no.1, pp. 30-47.
- Tilley, E, Lüthi, C, Morel, A, Zurbrügg, C & Schertenleib, R 2008, *Compendium of Sanitation Systems and Technologies*, Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dübendorf, Switzerland,

- viewed 16 December 2008, <http://www.eawag.ch/organisation/abteilungen/sandec/publikationen/publications_sesp/downloads_sesp/compodium_high.pdf>.
- UNCHS (United Nations Centre for Human Settlements) 2001, 'Tools to support participatory urban decision making', *Urban Governance Toolkit Series*, UNCHS Habitat, Nairobi, Kenya, viewed 16 December 2008, <<http://www.unhabitat.org/pmss/getPage.asp?page=bookView&book=1122>>.
- UNDP (United Nations Development Programme) 2006, *Human development report 2006 - Beyond scarcity: power, poverty and the global water crisis*, UNDP, New York, USA, viewed 16 December 2008, <<http://hdr.undp.org/hdr2006/pdfs/report/HDR06-complete.pdf>>.
- UNEP (United Nations Environment Programme) 2004, *Financing wastewater collection and treatment in relation to the Millennium Development Goals and world summit on sustainable development targets on water and sanitation*, UNEP, Nairobi, Kenya, viewed 16 December 2008, <<http://www.unep.org/GC/GCSS-VIII/K0470227%20INF4.pdf>>.
- UNESCO/IHP (International Hydrological Programme of UNESCO) & GTZ (Gesellschaft für Technische Zusammenarbeit) 2006, *Capacity building for ecological sanitation*, Paris, France & Eschborn, Germany, viewed 16 December 2008, <<http://www2.gtz.de/Dokumente/oe44/ecosan/en-ecosan-capacity-building-2006.pdf>>.
- UN-HABITAT (United Nations Human Settlements Programme) 2006, *State of the world's cities 2006/7*, UN-Habitat, Nairobi, Kenya.
- UN (United Nations) 2002, *Key commitments, targets, and timetables from the Johannesburg plan of implementation*, United Nations Department of Public Information, New York, USA, viewed 16 December 2008, <http://www.un.org/jsummit/html/documents/summit_docs/2009_keyoutcomes_commitments.doc>.
- UN (United Nations) 2005, *The Millennium Development Goals Report 2005*, United Nations Department of Public Information, New York, USA, viewed 16 December 2008, <<http://unstats.un.org/unsd/mi/pdf/MDG%20Book.pdf>>.
- van der Vleuten-Balkema, AJ 2003, *Sustainable wastewater treatment - developing a methodology and selecting promising systems*, PhD thesis, Technische Universiteit Eindhoven, The Netherlands.
- WCED (United Nations World Commission on Environment and Development) 1987, *Our common future*, Oxford University Press, Oxford, UK.
- WELL (Water and Environmental Health at London and Loughborough) 1999, *Sanitation Programmes Revisited*, London & Loughborough, UK, viewed 16 December 2008, <<http://www.lboro.ac.uk/well/resources/well-studies/full-reports-pdf/task0161.pdf>>.
- Werner, C, Panesar, A, Bracken, P, Mang, HP, Huba-Mang, E, Gerold, AM, Demsat, S & Eicher, I 2003, *An ecosan source book for the preparation and implementation of ecological sanitation projects*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany, viewed 16 December 2008, <<http://www.GTZ.de/de/dokumente/en-ecosan-source-book-2005.pdf>>.
- WHO/UNICEF JMP (World Health Organization and United Nations Childrens Fund Joint Monitoring Programme for Water Supply and Sanitation) 2005, *Water for life: making it happen*, WHO, Geneva, Switzerland & UNICEF, New York, USA, viewed 16 December 2008, <http://www.who.int/water_sanitation_health/monitoring/jmp2005/en/>.
- WHO/UNICEF JMP (World Health Organization and United Nations Childrens Fund Joint Monitoring Programme for Water Supply and Sanitation) 2006, *Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade*, WHO, Geneva, Switzerland & UNICEF, New York, USA, viewed 16 December 2008, <http://www.who.int/entity/water_sanitation_health/monitoring/jmpfinal.pdf>.
- WHO/UNICEF JMP (World Health Organization and United Nations Childrens Fund Joint Monitoring Programme for Water Supply and Sanitation) 2008, *Progress on drinking water and sanitation: special focus on sanitation*, WHO, Geneva, Switzerland & UNICEF, New York, USA, viewed 16 December 2008, <http://www.who.int/water_sanitation_health/monitoring/jmp2008/en/index.html>.
- WHO (World Health Organization) 2006, *Guidelines for the safe use of wastewater, excreta and greywater*, WHO, Geneva, Switzerland, viewed 16 December 2008, <http://www.who.int/water_sanitation_health/wastewater/gsuww/en/index.html>.
- Winblad, U & Simpson-Hébert, M 2004, *Ecological Sanitation – revised and enlarged edition*, EcoSanRes Program, Stockholm Environment Institute (SEI), Stockholm, Sweden, viewed 16 December 2008, <http://www.ecosanres.org/pdf_files/Ecological_Sanitation_2004.pdf>.
- Wright, AM 1997, *Toward a strategic sanitation approach*, UNDP-World Bank Water and Sanitation Program (WSP), Washington DC, USA, viewed 16 December 2008, <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1997/11/01/000009265_3980429110522/Rendered/PDF/multi_page.pdf>.
- WSSCC/Sandec 2000, *Bellagio statement: Clean, healthy and productive living: a new approach to environmental sanitation*, WSSCC (Water Supply and Sanitation Collaborative Council) Working Group Environmental Sanitation, Dübendorf, Switzerland, viewed 16 December 2008, <http://www.eawag.ch/organisation/abteilungen/sandec/publikationen/publications_sesp/downloads_sesp/Bellagio_Statement.pdf>.
- Zeeman G & Lettinga G 1999, 'The role of anaerobic digestion of domestic sewage in closing the water and nutrient cycle at community level', *Water Science and Technology*, vol. 39, no. 5, pp. 187-194.

5 Abbreviations

| | |
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| ADM | Adarsh Vidya Mandir |
| ASEM | Advisory Services in Environmental Management |
| ASIA-PRO-ECO | Name of a Programme of the European Union |
| BA | German Federal Employment Agency |
| BMZ | German Ministry for economic collaboration and development |
| BORDA | Bremen Overseas Research and Development Agency |
| BOT | Build Operate Transfer |
| CBNRM | Community Based Natural Resources Management |
| CBO | Community-Based Organisation |
| CBS | Community Based Sanitation |
| CGWB | Central Ground Water Board |
| CIM | Centre for International Migration |
| CPCB | Central Pollution Control Board |
| CSD | UN Commission on Sustainable Development |
| CSE | Centre for Science and Environment |
| CWC | Central Water Commission |
| DDWS | Department of Drinking Water and Sanitation |
| DEWATS | Decentralised wastewater treatment system |
| DHAN | Development of Human Action |
| DPR | Detailed project reports |
| DS | Dry Sanitation |
| DT | Dry Toilets |
| EcoSanRes | Ecological sanitation research – Swedish ecosan programme from SEI |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| ESA | External Support Agencies |
| ESF | Ecosan Services Foundation |
| EUR | Euro |
| GOI | Government of India |
| GTZ | German Technical Cooperation Association |
| HCES | Household Centred Environmental Sanitation Approach (HCES) of the WSSCC |
| IEC-Project | Information Education and Communication Project |
| IESNI | Innovative Ecological Sanitation Network India |
| IWWA | Indian Water Works Association |
| IYS | International Year of Sanitation |
| JNTU | Jawaharlal Nehru Technical University |
| KfW | Kreditanstalt für Wiederaufbau, KfW banking group |
| MDG | Millennium development goals |
| MJP | Maharashtra |
| MoRD | Ministry of Rural Development |
| MoWR | Ministry of water resources |
| NGO | Non Governmental Organisation |
| O&M | Operation and maintenance |
| PRI | Panchayati Raj institutions |
| R&D Project | Research and Development Project |
| RCRSP | Restructured Centrally Sponsored Rural Sanitation Programme |
| SCW | Shital Ceramic Works |
| Seecon | Society economy ecology consulting |
| SEI | Stockholm Environment Institute |
| SuSanA | Sustainable Sanitation Alliance |
| TSC | Total Sanitation Campaign |
| UDDT | Urine diversion dehydrating toilet |
| ULB | Urban Local Bodies |
| UNDP | United Nations Development Program |
| UNICEF | United Nations Children's Fund |
| UWSS | Urban Water Supply and Sanitation |
| WHO | World Health Organisation |
| WSHG | Women Self Help Group |
| WTO | World Toilet Organisation |

6 Map of India with project locations



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Organisations in the German Development Cooperation that contributed to this publication:**GTZ**

GTZ is an international cooperation enterprise for sustainable development with worldwide operations. It helps the German Federal Government achieve its development policy objectives. It provides viable, forward-looking solutions for political, economic, ecological, and social development in a globalised world. Working under difficult conditions, GTZ promotes complex reforms and change processes. Its corporate objective is to improve people's living conditions on a sustainable basis. By providing a wide variety of services – the most important of which is capacity development – GTZ translates the vision of sustainable development into reality.

www.gtz.de

www.asemindia.com

www.gtz.de/ecosan

KfW

KfW Entwicklungsbank is a competent and strategic advisor on current development issues. Reducing poverty, securing peace, protecting natural resources and helping to shape globalization are the main priorities of KfW Entwicklungsbank. On behalf of the German Federal Government it finances reforms, infrastructure and financial systems for socially and ecologically compatible economic growth. As part of KfW Bankengruppe it is a worldwide financing partner, and it also employs funds of its own for development projects. KfW Entwicklungsbank knows about the potentials and problems in developing countries thanks to its close cooperation with local partners and target groups. It actively seeks to cooperate with German and International partners in order to further enhance the developmental effectiveness and efficiency of its activities.

www.kfw.de

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The Centre for International Migration and Development (CIM) is the human resources placement organisation for German Development Cooperation. As a joint operation of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH and the International Placement Services of the German Federal Employment Agency (BA) CIM places managers and technical experts in Asia, Africa, Latin America, and Eastern and South Eastern Europe.

www.cimonline.de

BORDA

BORDA was founded in 1977 in Bremen Germany as a non-profit organization with the goal of developing new methods of using renewable energy to alleviate poverty and, through the implementation of development programmes, to improve the living conditions and social structures in disadvantaged communities abroad. This is accomplished through the facilitation of demand-oriented basic needs services in the sectors of decentralized sanitation, water and energy supply. In the majority of the projects implemented BORDA acts on behalf of the Federal Ministry for Economic Cooperation and Development or on behalf of the Free Hanseatic City of Bremen.

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This publication brings together contributions to Indo-German development cooperation in the field of sustainable sanitation from:



BORDA

