012 TepozEco, Mexico

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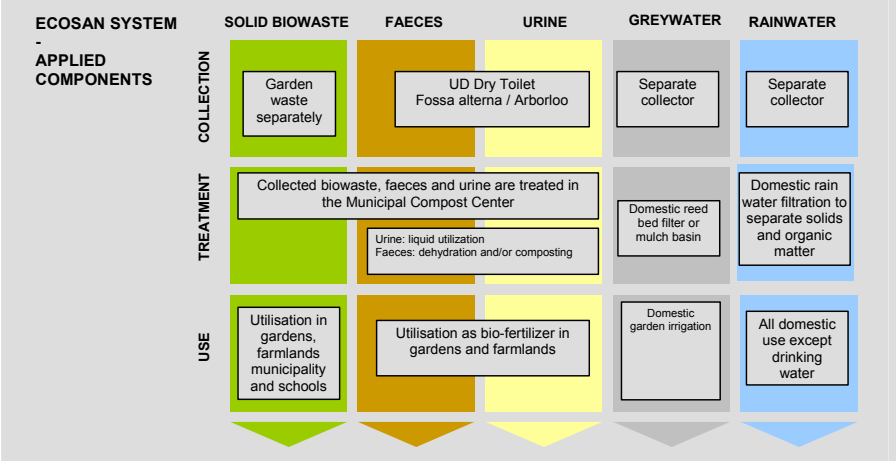
TepozEco urban ecosan pilot program

Tepoztlán, Mexico



1 General Data

Type of Project:

Municipal ecological sanitation / ecological retrofitting of urban and periurban settlement project

Project Period:
Start of planning: January 2002
Start of operation: January 2003

Project Scale:
Municipality of more than 35,000 -- including an integrated ecological sanitation closed–loop system in one periurban community.

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Planning Institution:
Sarar Transformación SC / EcoSanRes

Executing Institution:
Sarar Transformación SC

Supporting Agencies:
Stockholm Environment Institute SEI / Ecosanres, Sweden

WASTE/ Advisors on urban environment and development, Netherlands

NCCR North-South / Sandec-Eawag, Switzerland

United Nations Development Program / Energy & Environment Group (UNDP/BDP/EEG)

Comisión Estatal de Agua y Medio Ambiente - CEAMA (Morelos State Water and Environment Commission)

Insituto Nacional de Desarrollo Social – INDESOL (National Institute for Social Development)

Fundación Comunidad AC

Taller Artes y Oficios - TAO (Arts and Skills Workshop)

Tepoztlán Valle Sagrado A.C. (Tepoztlán Sacred Valley)

Figure 1: Tepoztlán *(source: TepozEco)*

2 Objective of the project

- To establish, within 4 years, a fully functioning example of urban ecological sanitation within a neighbourhood of the municipality of Tepoztlán, Mexico. The system shall include household eco-toilets, a functioning system of communal collection of organic refuse, one or more eco-stations for secondary treatment of toilet output, greywater and organic solid waste management and recycling of nutrients for urban agriculture.
- To provide an example for implementing ecosan systems within a Latin American municipal context.

3 Location and general conditions

Figure 2: Location in Mexico *(source: TepozEco)*

Tepoztlán, a small urban centre 70 km south of Mexico City, has a special history of environmental activism, strong local leadership and commitment. This municipality presents enormous contrasts that range from poor indigenous villages to luxurious weekend homes. That socio-economic situation is, in many ways, a microcosm of contrasting conditions prevalent in much of Mexico and Latin America.

Tepoztlán is located at the top of its watershed, within a national park and an important biological corridor. This municipality has been included in a comprehensive development program, sponsored by the Ministry of Tourism, which aims at conserving the natural and cultural heritage of 16 distinctive Mexican towns. As a tourist destination the municipality is both politically and environmentally strategic.

Because of its high location Tepoztlán does not receive waters from upstream villages. But the clean water flowing down the mountains, after passing through various settlements, gets pol-

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luted with greywater and black water as well as by garbage dumped into the ravines and rivers. An estimated 70% of the urban population uses waterborne toilet systems emptying into septic tanks that seldom conform to acceptable standards. Adequate emptying and maintenance rarely take place; so the improperly treated effluent drains into the soil and underground fissures. Recent water quality tests indicate that the aquifers, which supply water to most of the population, are being contaminated by nitrates and phosphorous as well as detectable levels of faecal and total coliformes.

4 Technologies applied

1. Urine-diverting dry toilets, constructed with passive solar design and built with natural or traditional materials. Over 30 UD dry toilets have been installed with:
   - One dehydrating chamber with 2 large capacity plastic containers (on wheels) for faeces collection, storage and pre-treatment.
   - Urine harvesting in 20 l plastic containers
   - South facing vent pipe and fly trap
2. Low-cost shallow pit composting sanitation system prototypes for poor peri-urban and rural popula¬tions (Arborloo and Fossa Alterna).
3. Reed-bed or mulch greywater filtering systems for physical and biological treatment.
4. Public, institutional, domestic waterless male and female urinals with a yearly collection goal of 6000 l.
5. Organoponics: A culti¬vation technique in containers or garden beds, mostly filled with dry leaves, soaked with fermented human urine and a top layer of soil to produce vegetables.

Figure 3: Organoponics *(source: TepozEco)*

6. Rainwater harvesting and pretreatment by sedimentation and volcanic gravel filtration. Local rainwater harvesting potential of over 1 m³ per m² of roof surface.

A household-centred approach is followed, beginning at the domestic sphere, addressing problems by closing loops as much as possible, then moving up to a neighbourhood level and lastly, if required, at the municipal level.

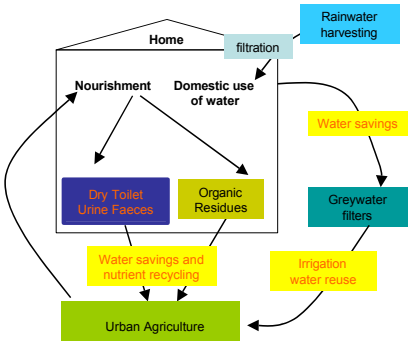

Figure 4: Diagram closed loop household centred approach *(source: TepozEco)*

The range of tools used for community education and mobilization are drawn for the SARAR methodology, which has been used in a wide range of ecosan and social development programs:

Self-esteem

Associative strengths

Resourcefulness (creativity)

Action-oriented planning

Responsibility for follow-through (commitment)

5 Type of reuse

The introduction of an integrated system for the recovery and reuse of organic residues in the urban context of Tepoztlán is a key strategy for recycling valuable nutrients to support sustainable agriculture and to stimulate self-reliance. The TepozEco program emphasis on urine harvesting and dry eco-toilets has the additional aim of conserving water, an important consideration given the accelerated urbanization and growth of tourism in the municipality.

Figure 5: Urine fertilization on corn crops *(source: TepozEco)*

Several reuse options have been implemented:

- Application of harvested urine as fertilizer and dehydrated faeces as soil conditioner in backyard gardens and on field crops.
- Reuse of organic residues in organoponic gardens.
- Application of harvested urine for fertilizing soccer field lawns.
- Composting of garden residues in the Municipal Composting Centre with an achieved volume of 300 m³ of compost.
- Use of urine on compost piles as process accelerator.
- Treated greywater reuse for irrigation.

6 Project components

The program components include:

- Design of ecological toilets, primarily UD dry toilets as well as other low-tech and low-cost sanitation systems (arborloo, fossa-alterna).
- Integrated water management to ensure that both population and local authorities recognize the real and critical situation of potable water supply as well as the importance of designing and applying water conservation, treatment and protection measures.
- Greywater management in household and larger scale projects, including local watershed (streams and ravines) conservation.
- Urban agriculture: separation and management of organic residues (urine, sanitized faecal material as well as kitchen and garden refuse).
- Environmental education and training, including local, national and international ecosan promotion.
- Management, monitoring and evaluation to assure the effective execution of the project's different phases.

The TepozEco project is organized into 5 sub-projects:

- Integrated Water and Sanitation Management
- Eco-Station: Consolidation of the Municipal Composting Centre to receive and process a range of organic solid residues as well as promotion of neighbourhood and domestic composting.

- Urine Harvesting

Figure 6: Urine harvesting *(source: TepozEco)*

- Holistic Community Application: The San Juan Tlacotenco subproject aims to generate a critical mass of eco-toilet prototypes to serve as a replicable model for other Latin American communities.
- Ecosan Education and Demonstration Centre.

Figure 7: Municipal Composting Centre *(source: TepozEco)*

7 Project history

1999-2000: "Closing the Loop" Workshop in Cuernavaca Mexico (UNDP-UNICEF). Consolidation of RedSeco (Ecological Sanitation Network).

2001: Tepoztlán municipal authorities join RedSeco.

2002: TepozEco Pilot Project Proposal / Tepoztlán municipal authorities visit China and signing of tripartite agreement (Tepoztlán-SEI-SARAR).

2003: TepozEco Project begins.

8 Costs

Investment, operation and maintenance costs are financed by several organizations:

Year 2005:

SEI: Core funding, technical specialists administration = $105,000 USD

UNDP: Applied research, study visits = $34,200 USD

NCCR-NS/PAMS: San Juan community ecosan project = $26,092 USD

CEAMA: Material subsidy for domestic ecosan systems = $22,017 USD

Year 2004:

SEI: Core funding, technical specialists administration = $100,000 USD

NCCR-NS/PAMS: Urine harvesting project = $20,000 USD

INDESOL: Education Material = $2,700 USD

Tepoztlán Municipality: Eco-Station In-Kind support = 10,028 USD

Cost examples of a typical toilet with UD seat, male urinal and wash basin: $1,000 USD (including building materials, accessories and labour)

Fossa Alterna / Arborloo: $25 - $300 USD (depending on building material)

Greywater filter: $150 USD (including building material and labour)

9 Operation and Maintenance

Normal O&M is responsibility of families. Those who cannot or do not want to reuse their urine and feaces in their own gardens can bring their product to the Demonstration Centre or to the Compost Centre.

TepozEco provides O&M workshops for ecosan system owners to ensure their proper use.

Figure 8: Ecosan Workshops at Demonstration Centre *(source: TepozEco)*

Once the dry toilet is set up and in use, TepozEco's technical team makes regular follow-up visits until faecal containers are full and the initial contents are emptied, in order to guarantee proper use of the ecosan's system.

In the case of San Juan Tlacotenco, a local youth group (Impetu Joven) is developing a recycling centre with composting of organic residues and a plant and tree nursery as a resource for home gardens and reforestation programs. They will provide a urine collection Service in San Juan.

10 Design information and technical specifications

The designs were made based on observations of unsustainable local practices, as well as water shortages.

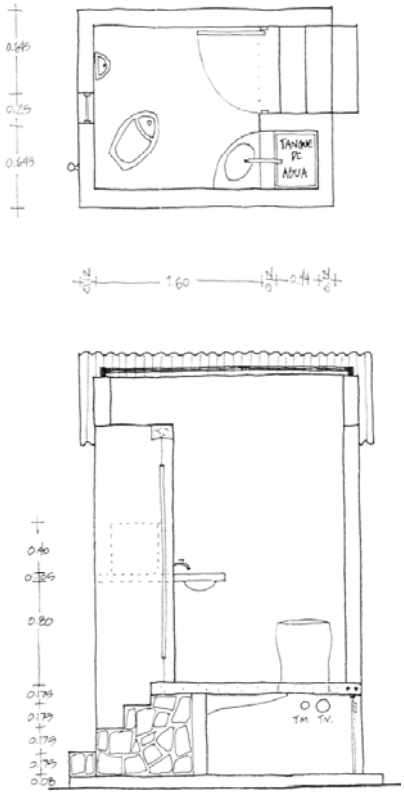

Figure 9: Sketches / picture of ecosan toilets *(source: Tepoz Eco)*

Figure 10: Dehydrating chamber with 2 containers for faeces *(source: TepozEco)*

11 Practical experience and lessons learned, comments

The work of the TepozEco project to date has resulted in:

- Integration of dry toilets within households, improving security for users, especially women and children.
- Creation of a network of partnerships with other groups and institutes that share concerns for an appropriate, sustainable and environmentally friendly "waste management" system.
- Demystification of human urine for use as fertilizer.

The project has also met with resistances to ecosan due to:

- Lack of knowledge and understanding of limitations and risks involved with conventional sanitation systems.
- Scepticism about the convenience and hygiene of ecological dry toilets.
- Lack of understanding of the benefits of ecological sanitation.
- Lack of experience in government personnel.

Other challenges to be faced include:

- Inherent cultural patterns tend to assign responsibility for waste handling to local authorities or simply to not address urban waste issues.
- Lack of an updated municipal sanitation regulatory framework. Existing norms do not recognise ecological alternatives as sanitation options.
- Dry toilets require a large investment for potential users who may not be totally convinced of the comparative advantages of ecosan.
- Lack of appropriate incentives, subsidies or other financial mechanisms inhibits project implementation.
- Retrofitting poses considerable construction challenges in adapting the installation to the existent local infrastructure.

12 Available documents and references

- Closing the Loop: Ecological sanitation for food security, S. Esrey, I. Andersson, A. Hillers, R. Sawyer - UNDP / Sida -Swedish International Development Cooperation Agency, 2001.

  http://www.sarar-t.org/PDFS/closing-the-loop.pdf
- Ecological Sanitation – revised and enlarged edition - Uno Winblad / Mayling Simpson-Hebert / Paul Calvert / Peter Morgan / Arno Rosemarin / Ron Sawyer / Jun Xiao / et al, Stockholm Environment Institute, 2004.

  http://www.ecosanres.org/PDF%20files/Ecological%20Sanitation%202004%20high%20res.pdf
- PHAST Step-by-step Guide: A participatory approach for the control of diarrhoeal disease (WHO / EOS / 98.3) – Ron Sawyer, Mayling Simpson-Hebert, WHO, Sida, WSP - 1998

  http://www.who.int/water_sanitation_health/Environmental_sanit/PHAST/phast96-11/96-11index.htm
- Legal constraints possibilities for eco-sanitation in Mexico; Sarar Transformación - Ron Sawyer, Luis Enrique Ramos Bustillo and Ana Cordova
- UNEP ROLAC recommendation on municipal WW and basic sanitation for Latin America and the Caribbean; Sarar Transformación SC, Ron Sawyer, Anne Delmaire, Andres Buenfil.

These documents are available at Sarar Transformación SC upon re-quest.

- Technical guides on Ecological Sanitation by Taller Artes y Oficios (TAO) & Sarar Transformación SC, available in Spanish:
  - Biofiltro (greywater filter guide)
  - El sanitario de huerto (Arborloo guide)
  - Hortaliza de traspatio (Backyard garden

DVDs and videos of harvesting and storage applications:

http://www.sarar-t.org/publicaciones.htm

13 Institutions, Organisations and contact

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