bcsd singapore

Providing safe and affordable drinking water in rural tropical Asia

The Issue

Traditional sewage and wastewater treatment facilities are uneconomical in remote and rural areas – or more generally, in low population density areas. Furthermore, know-how and financial means are often lacking in developing countries to build, run and maintain those facilities. As a consequence:

- Wastewater from toilets reaches the groundwater untreated
- People get sick or even die from drinking contaminated water collected at the well
- People spend a high proportion of their income on bottled drinking water

The Solution

This initiative is conducted under the umbrella of a leading NGO working in collaboration with business and academia. Together, we provide the following:

- A business model that brings the construction of an individual sanitation system within financial reach for every household in rural Indonesia
- A technical solution that is affordable, does not require maintenance, can be self-built with minimum material requirement, and improves social standing by eliminating bad smell
- Safe drinking water: as a result, the household well is available once again, as a water source.

The Technology

We call the individual, on-site treatment of wastewater a "Wastewater treatment Garden" (WWG). The technical solution is based on the guidelines[1] that were compiled by GTZ in cooperation with Oxfam, IFRC and UNICEF in the wake of the Aceh Tsunami.

The system has three main components (refer to picture on next page)

1. The primary treatment – in the form of an airtight septic tank and piping
2. The secondary treatment – in the form of a "Garden" or vegetated leach field, made of stones, gravel, white sand, a brick rim and a "nutrient remover" such as, for example, banana trees
3. A ceramic filter (a separate portable US$30 solution, not pictured below)

The septic tank kills some harmful bacteria and produces nutrients; the plants in the "Garden" use up the nutrients; the resulting wastewater is filtered through the soil into the groundwater; water is collected at the well; and the small pore-size ceramic filter removes remaining dirt, debris and bacteria.

[1]Guidelines for the Selection and Implementation of Sustainable Sanitation Systems for the Reconstruction in Aceh and Nias. February 2007.

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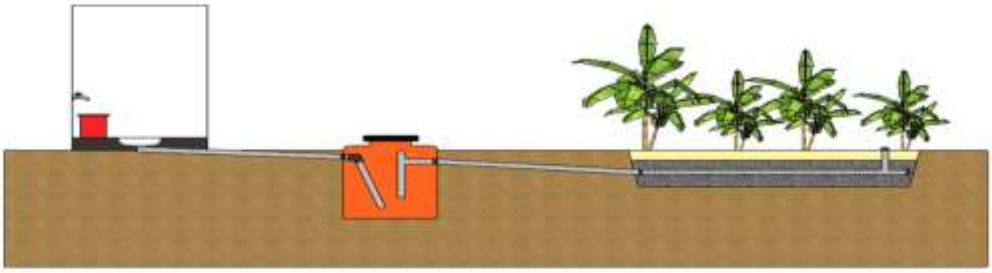

The Initiative

The first phase of this project is scheduled to start in November 2016. It consists of an international "technical" research project described below. The second phase is about scaling up the solution throughout and possibly beyond Indonesia, which will involve research on the social dynamics involved in a successful roll-out as well.

Phase 1: Applied research project

A world-class scientific team from 3 top universities in Indonesia, Holland and Singapore will analyse the system's performance and cost-optimise the solution, with the purpose to determine the best system efficiency (in terms of health, environment and social acceptance) at the lowest cost and at the greatest ease of local production. The focus will be on individual household systems, but community gardens, such as for schools for example, could be considered as an extension project.

The research base is in Bintan (Indonesia), near LooLa Adventure Resort. About 70 such WWG's of various sizes have already been built here. In addition to studying the existing systems, the research teams will construct 50 new WWG's under controlled variable conditions. The goal is to assist in reaching conclusions about cost/performance/social optimization. This initiative is open source, with all data and results to be made publicly available.

Phase 2: Scaling up

Social science and business expertise will be deployed to identify successful conditions to scale up the solution in Indonesia and beyond. Private sector companies, with large land concessions, may want to implement this solution to the benefit of local communities. Micro-finance institutions and development agencies may set up country-specific initiatives, using the design and results from the applied research. The system needs to speak to local people, of course, as their enthusiasm for adoption will ultimately decide on the system's success. People's views will be sought, carefully considered, and used to formulate an overall model for large scale adoption.

The business case

Current total cost for a single WWG: **SG$500**

Estimated breakdown: septic tank & pipes (40%); sand, gravel, cement, ceramic filter, banana trees (40%); labour for excavation and installation (20%). Land requirement: 8-10m^2

Bottled water average cost per household: **SG$30/month** (source: field survey Bintan)

Loan repayment has to be equivalent to monthly expenditure on bottled water i.e. monthly loan instalment = SG$30/month. With an interest rate at 2% per month over 24 months, the available loan to build one WWG amounts to SG$460.

The **current** payback is 2 years. Households benefit from a smell-free house (improved social status), free safe drinking water, and improved health leading to higher productivity.

The **research target** is to bring the same benefits at lower cost.

Partners

LooLa Adventure Group
www.loola.net
Role: Project initiator; project management and implementation
Contact: Dr Marc VAN LOO info@loola.net
Profile: Asia's most highly decorated Eco resort, World # 1 Responsible Tourism Operator (2015). Offers a wide range of adventure and community-based/CSR activities. For active families, schools and other groups. Acts as a test-bed for sustainable business solutions. Located in beautiful coastal strip on Bintan, Indonesia. Member of BCSD Singapore.

Business Council for Sustainable Development Singapore and World Business Council for Sustainable Development
www.bcsd.org.sg and www.wbcsd.org
Role: Value proposition formulation, and convener of partners and funders. Project management and promotion for scaling up implementation in Indonesia and beyond.
Contact: Mr Constant VAN AERSCHOT constant@bcsd.org.sg
Profile: CEO-led business association of forward-thinking companies that aims at creating a sustainable future for business, society and the environment. Registered non-profit organisations.

Eindhoven University of Technology, The Netherlands
www.tue.nl
Role: Lead research organisation
Contact: Mara Wijnker m.a.s.g.wijnker@tue.nl
Profile: a leading European research university. Ranked by the EU Commission at third place among all European research universities.

Universitas Gadjah Mada, Yogyakarta, Indonesia
www.ugm.ac.id/en
Role: Research partner to TU/e
Contact: Prof. Dr. Ir. Lilik Sutiarso, M. Eng.
Profile: Indonesia's oldest and largest institution of higher education. A public research university, comprising 18 faculties and 27 research centers. UGM offers 68 undergraduate, 23 diploma, 104 master and specialist, and 43 doctorate programs, from Social Sciences to Engineering. UGM has 55,000 students and has 2,500 faculty members.

National University of Singapore
www.nus.edu.sg
Role: Research partner to TU/e
Contact: Dr NG How Yong, Director Centre for Water Research. howyongng@nus.edu.sg
Profile: Part of NUS Dept. of Civil & Environmental Engineering, one the mission of the CWR is to conduct R&D on water and wastewater engineering for water infrastructure needs in Singapore and the regional countries.

Borouge
www.borouge.com
Role: Provides funding for the septic tanks for the research-related WWGs on Bintan
Contact: Mr LOU Kum Hoong. kumhoong.lou@borouge.com
Profile: One of the world's largest plastic producers, committed to demonstrating that plastic can be a force for good. Part of Borealis Group, member of WBCSD.

AS Schneider Asia-Pacific Pte. Ltd
www.as-schneider.sg
Role: Provides funding for building the research-related WWGs on Bintan
Contact: Mr Tim-Frederik KOHLER. t.kohler@as-schneider.com
Profile: German based world-leading manufacturer of instrumentation valves and manifolds. It develops cutting edge sealing technology that reduces valve emission rates 10,000 times compared to a standard valve head unit.

Annex

How it works (see sketch page 2)

- Wastewater flows from the toilet into a waterproof septic tank
- Septic tank size is designed to equal roughly two days of wastewater production
- A sludge layer will form in the septic tank, depriving bacteria from oxygen. Here, most of the harmful bacteria get killed.
- Wastewater still contains harmful nutrients, mainly nitrates
- Residual nutrient-rich wastewater flows through a perforated pipe in the vegetated leach field, or “garden"
- The garden is made of small stones at the bottom, white sand on top, and banana or palm oil trees
- The trees feed directly off the nutrients coming through the pipe
- Wastewater sinks through the ground to reach groundwater
- Water is collected at the well. Water is then filtered through a ceramic filter before consumption

Trialled and tested in Bintan

- 7 WWG of various sizes have been in operation since 2014 at the LooLa Adventure Resort premises, on the island of Bintan in Indonesia
- 70 WWG have been built by LooLa’s guests for households in neighboring villages
- Villagers equipped with WWG’s have been drinking water from the well. They report to prefer its taste over bottled water, enjoy the money saving measure, benefit from a house and surroundings that no longer smell, and gain a beautiful garden which allow them to receive family and friends proudly
- Demand is increasing, with a waiting list of households requesting a WWG

Mock up used as learning tool for guests at LooLa Adventure Resort in Bintan, Indonesia