

A SLUM TOILET

- Removes germs from human waste and recovers valuable resources such as energy, clean water, and nutrients.
- Operates 'off the grid' without connections to water, sewer systems, or electrical lines.
- Costs less than 5 cents per user, per day.
- Promotes sustainable and financially profitable sanitation services and businesses operating in poor urban settings.
- Is a truly aspirational, next-generation product everyone will want to use - in developed and developing nations alike.



EOOS HAS WORKED WITH BRANDS LIKE ARMANI AND ADIDAS FOR ALMOST 20 YEARS. THESE CAN ALSO BE FOUND IN SLUMS. FAKE OR NOT, SUCH EXPRESSIONS OF A GLOBALIZED CONSUMER CULTURE UNDERLINE THE POTENTIAL FOR SOCIAL DESIGN PROJECTS TO LEVERAGE THE POWER OF STATUS.

By Harald Gründl

Reinvent The Toilet Challenge

In 2011, the Bill and Melinda Gates Foundation invited universities around the world to submit ideas for transformative technologies in sanitation. Eawag teamed up with EOOS and received a grant. The 'Reinvent the Toilet Challenge' aims to create a toilet that:

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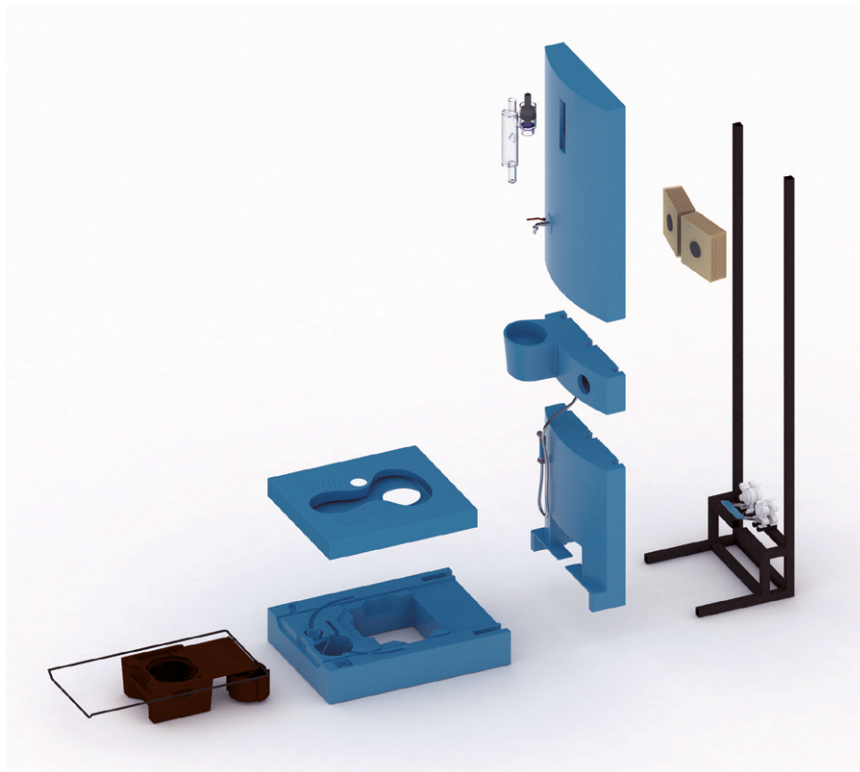
In 2008, EOOS began a research project to identify new opportunities in the field of sustainable design, focusing not on products, but entire systems. It is nice to design a bathtub, but where does the water go? And where does it come from? These questions are usually not asked in the context of a design commission. But these questions on a systemic level are key to real innovation. And innovation is also achieved by changing the context of design. So we travelled to Zürich to visit Eawag, one of the world's leading aquatic research institutes, to discuss opportunities for collaboration. I met with Tove Larsen, a research-

er passionate about developing innovative waste water treatment by introducing urine separation (No-Mix toilets). She had a very inspiring explanation for her idea: in our body, waste streams are separate as well. But at that time, there were only a few suppliers for urine separating flush-toilets in the developed world.

People liked the idea of smart waste water treatment in the context of pilot projects. But the usability of the toilets was bad. Industry did not really take seriously the challenge of reinventing the flush system. And the waste water industry and com-

The criteria represent a considerable challenge: an outer space toilet affordable for the urban poor, but aesthetically pleasing enough for Bill Gates to want to use in his own home. What is special about our project was the early involvement of design decisions in a technology driven development process. Larsen became principal investigator of the project, I became principal designer. EOOS had the opportunity to shape technology from the beginning. To save on expensive building costs, we decided to retrofit existing superstructures. The idea was a product-service system where the toilet hardware is rented out to the users. The toilet is like a piece of furniture that can be placed everywhere. It is engineered for the use of ten people or two families as a shared toilet. Although a pedestal is more prestigious, we opted for a squatting type toilet to ensure optimum hygiene.

Exploded perspective of the 'Blue Diversion Toilet'



Technically, the engineers needed a dry urine-diverting toilet where the faeces and urine would be collected two times a week by service persons, and treated at a decentralized processing plant that could fit in half a cargo container. The energy of the faeces would run the process of generating fertilizer from the urine. But dry toilets, especially urine-diverting toilets, are not well received by their users. Smell and dirtiness are the key problems. So the project team came up with the idea to flush the dry toilet, while adding a wash basin for hand washing and a hose for bottom cleaning – everything a bathroom should have, no matter where you are in the world. The toilet recycles all the water through a gravity-driven biological membrane on site. All three streams – water, faeces and urine – are kept separate. A valve in the urinal bowl of the toilet automatically splits the water from the urine stream when it is flushed.

module. The focus group approved. We never intended to design a slum toilet, but rather a solution we would like to use as well. The color of the toilet was discussed with social scientists at the university before the trip. They asked us not to use

THE TEST FAMILIES WERE SO PROUD OF THE TOILET THAT GUESTS WERE FREQUENTLY INVITED TO SEE THE LUXURY BATHROOM THEY COULD USE.

any shade associated with local political parties. I had never thought about color in that way! So we came up with a special blue, used to paint swimming pools. And for the kids we brought color pens to help us with alternative color designs.

The Gates Foundation liked the design as well, so we received special recognition for 'outstanding design of a toilet interface' and \$40,000. This allowed us to progress to the second phase of the project – the first field test with a working model. For the first time the design and the technological modules had to be married. The four water treatment modules tested in Eawag's research lab already had a shape that could be integrated into our design. In a very short time, we constructed the

design elements of the working model at EOOS, and combined these with the modules from the lab. We felt more like plumbers than designers.

The Kampala Field Test

In April 2013 we had heavy luggage with us on the flight to Kampala. At Makerere University we reconstructed the toilet for pre-testing. The controlling unit is an 'Arduino' microprocessor – an open source electronic platform. A polarity reversal killed the Arduino during setup. Days on the back of a motorcycle taxi followed to find new electronic components locally. Finally, a former student delivered a new microprocessor. The toilet was brought to the first test site on a small truck, a sanitation center in the slum of Mulago. Neighborhood children welcomed us, but eventually there were so many we had to shut the door of the community center to complete the final setup. The opening event was supported by a local DJ playing Bobi Wines' 'Toilet Song'. Eawag's social scientist took the chance to recruit the first people for interviews. From April to June, across four public events and 30 workshops, more than 300 interviews were conducted to evaluate the design features of the toilet. In a second stage, the toilet was tested in Kisalosalu slum in a specially built superstructure. Three families used the toilet for two weeks each, and provided feedback.

During the field test, more than 500 household surveys were conducted. As a result, we had a good picture of the features people liked and disliked, their willingness to pay rent for the toilet, and a deeper insight into the decision-making processes of future clients. People were willing to pay for good sanitation. And the test families were so proud of the toilet that guests were frequently invited to see the luxury bathroom they could use. This was what we wanted to achieve – a toilet that endows status on the people who use it. When it is a status statement, then people are willing to invest in their health through sanitation. Over 2.5 billion people practice open defecation or lack adequate sanitation facilities. An additional 2.1 billion urban residents use facilities that do not safely dispose of human waste. A substantial market for effective sanitation solutions!

The Nairobi Field Test

With this information gathered, and an acceleration grant from the Gates Foun-

A public demonstration held during the Kampala field test



dation secured, we are proceeding to the next project phase. The water wall has been engineered for serial production in rotomoulding. This is an industrial production method used in septic tanks and could be undertaken locally in African countries. We visited 'Sanergy', a pioneering sanitation project designing and manufacturing low-cost, high-quality sanitation facilities and distributing them via a franchise system. Sanergy has a well-functioning collection service for urine and faeces through their 'fresh life' operators – a perfect setup to test our toilet in a real service scenario in a slum context. The field test has to prove that our toilet has 'TRL 7'. 'TRL' is the abbreviation for 'Technology Readiness Level', used by NASA to evaluate the progress of rocket development. The Gates Foundation uses the tool to evaluate grants. Level 7 means the technology has been successfully tested in an operational environment. The TRL scale has nine steps, and the next challenge for the project will be a larger field test with many toilets to progress to level 8.

The 'Blue Diversion Toilet'

Parallel to the preparations for field testing, the design of the identity of our product-service system has begun. A strong identity is a key success factor when in-

roducing new services in developing countries. The availability of water is our unique selling proposition. And luckily this point is so strong that considerable interest exists from potential industry partners in the developed world. We still lack adequate sanitation solutions for construction sites, open-air festivals and similar applications. We hope this interest will ultimately accelerate the distribution of our toilet in the developing world. The Gates Foundation has an 'open access'

policy, ensuring good ideas spread without copyright restrictions. It is difficult to establish a business based on sanitation services in the developing world. So the big question will be whether local entrepreneurs will run such a business, or if it will require city authorities to introduce such solutions. Based on information from the field test, families are willing to pay for their private toilet service. Our project is only a stepping-stone to help improve living standards in informal settlements. ♥

Transporting the 'Blue Diversion Toilet' during the Kampala field test

