

AUGUST 14-15, 2012 | Bill & Melinda Gates Foundation

# REINVENT

•THE•

# TOILET FAIR



BILL & MELINDA  
GATES *foundation*



The Reinvent the Toilet Fair showcases innovations from around the world that are creating a new vision for the next generation of sanitation.

The fair aims to inspire collaboration around a shared mission of delivering a reinvented toilet for the 2.5 billion people worldwide who don't have access to safe and affordable sanitation.

The fair features the foundation's Water, Sanitation & Hygiene team's earliest technology bets—most of the work presented received funding just over a year ago. During that time, grantees and partners have made some promising progress. The exhibits include efforts to reinvent the toilet, and approaches to improve the collection, treatment, and disposal of human waste.

We hope the fair spurs partnerships and conversations about how we can work together to bring sanitation to those who need it most.

### What does a reinvented toilet look like?

- It removes pathogens from human waste and recovers valuable resources such as energy and nutrients that can be used as fertilizer.
- It operates “off the grid” without connections to water, sewer, or electrical lines.
- It costs less than 5 cents per user per day.
- It is a truly aspirational next-generation product that everyone will want to use—in wealthy as well as developing nations.

## Reinvent the Toilet Fair Program

### TUESDAY, AUGUST 14

**Exhibits Open – 10 a.m. to 5 p.m.**

*Conference Center and Campus Courtyard*

**Fair Opening – 10 a.m. to 10:20 a.m.**

*Conference Center – Whidbey and Camano Island Rooms, first floor*

**Welcoming Remarks** – Chris Elias, President, Bill & Melinda Gates Foundation, Global Development Program

Doulaye Kone, Senior Program Officer, Bill & Melinda Gates Foundation, Water, Sanitation & Hygiene Initiative

**Lunch – 11:30 a.m. to 12:30 p.m.**

*Conference Center – Lake Rooms, first floor*

**Reinventing the Toilet Award Ceremony – 2:15 p.m. to 2:35 p.m.**

*Conference Center – Whidbey and Camano Island Rooms, first floor*

**Award Presentation** – Bill Gates, Co-chair, Bill & Melinda Gates Foundation

**Remarks** – His Royal Highness the Prince of Orange, Chair of the United Nations Secretary General's Advisory Board on Water and Sanitation

**Reception – 5:00 p.m. to 7:00 p.m.**

*Atrium*

### WEDNESDAY, AUGUST 15

**Exhibits Open – 10 a.m. to 5 p.m.**

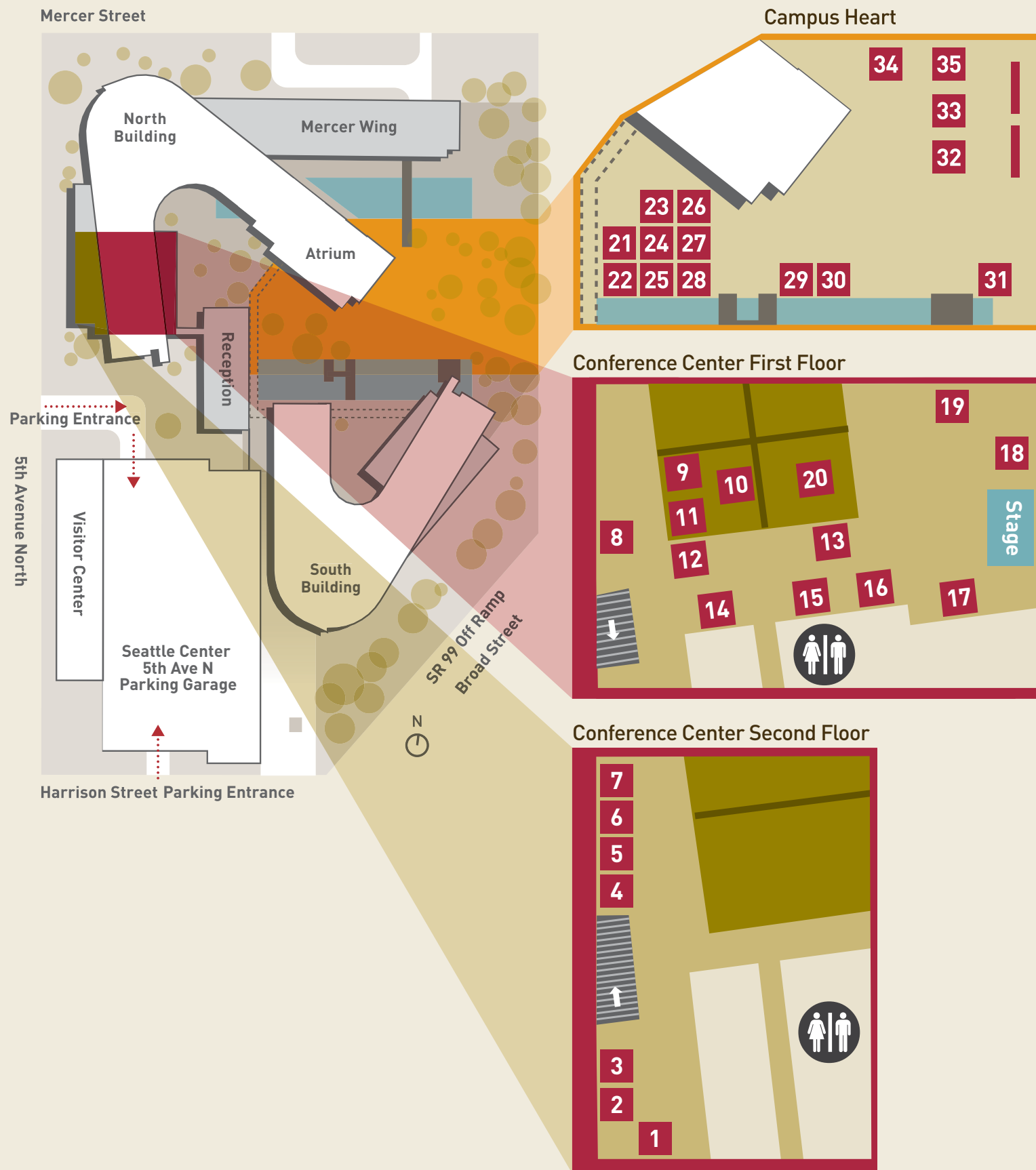
*Conference Center and Campus Courtyard*

**Lunch – 11:30 a.m. to 12:30 p.m.**

*Conference Center – Lake Rooms, first floor*

**Community Partner Event – 5:00 p.m. to 8:00 p.m.**

*Local community members and foundation staff and families are invited to tour the exhibits and selected areas of the foundation campus.*



## About the Exhibits

The fair features foundation Reinvent the Toilet Challenge and Grand Challenges Explorations grantees, and others whose work is aligned with efforts to reinvent the toilet.

**Reinvent the Toilet Challenge** In June 2011, the foundation awarded eight universities grants of approximately \$400,000 to leverage, in one year, advances in science and technology to create a waterless, hygienic toilet that is safe and affordable for people in the developing world.

**Grand Challenges Explorations** These grants were awarded in April and November 2011. Each grantee received \$100,000 to develop components of, or complete, non-networked sanitation solutions in one of four thematic areas:

- Latrine pit and tank emptying
- Recovery of energy from fecal sludge for safe and affordable treatment and disposal
- Sanitation solutions for areas challenged by an abundance of water
- Easy-to-clean, attractive, and affordable latrine and squatting platform technologies

**Other Exhibitors** These are foundation grantees and partners working on projects aligned with reinventing the toilet. The investments range from \$750,000 to \$5 million. Exhibitors are showcasing a range of work, including latrine emptying solutions, user-centered designs for public toilet facilities, and insect-based latrines that decompose feces faster.

## Exhibitors

### 1) Fecal Sludge Omni-Ingestor

*Participating firms: AGI Manufacturing; Synapse Product Development and DCI Automation; Beaumont Design Inc. USA*

A new technology to increase the efficiency, efficacy, and affordability of emptying pit latrines and septic tanks in the developing world. It will replace manual emptying with mechanical pit emptying, even in difficult-to-access peri-urban areas. The ingestor will be designed to separate water, sand, and trash from sludge and sanitize these byproducts on site, thereby reducing the amount of material that needs to be transported to waste treatment plants.

**Other Exhibitor**

### 2) Educating children and their caregivers about good water, sanitation, and hygiene practices

*Sesame Workshop*

*USA*

Sesame Workshop, throughout its over 40 year history of producing Sesame Street around the world, has used media to address critical health issues facing children, caregivers, and adults in the developing world. The workshop and its local partners have addressed issues related to water, sanitation, and hygiene by developing a range of media content (including print, television, and DVDs) for reaching children, caregivers, and adults to promote positive behaviors related to handwashing, hygiene, and water conservation.

**Other Exhibitor**

## Exhibitors

### 3) World Toilet Organization

*Singapore*

The World Toilet Organization is an organization dedicated to improving sanitation globally through powerful advocacy, inventive technology, education, and building market opportunities.

**Other Exhibitor**

### 4) Project Sammaan

*Institute for Financial Management and Research (IFMR) represented by Quicksand*

*India*

An exercise in reimagining the user interface and user experience for shared sanitation in India. In collaboration with two municipal governments, the project seeks to design and build 119 community sanitation facilities featuring user-centered innovations in architectural design, communication design, business model design, operations, and maintenance. Intended as a “market readiness” investment for new technologies like the reinvented toilet that will initially service groups of households rather than single families.

**Other Exhibitor**

### 5) Improved latrine pans for pour-flush systems

*American Standard Brands*

*USA*

A demonstration of three new concepts for improving pour-flush latrine pans, which are commonly used in Bangladesh, India, and other areas of South Asia. One design provides a reliable, hygienic water seal, and functions on only 1.5 liters of water with no required change in user behavior.

**Other Exhibitor**

### 6) The Great WASH Yatra: A sanitation and hygiene advocacy campaign

*Participating organizations: WASH United; Quicksand Design Germany and India*

“The Great WASH Yatra” is a sanitation and hygiene campaign in the form of a carnival that travels from Delhi to Mumbai. The campaign will include opportunities for participants to engage with sanitation and hygiene issues, Kinect-based sanitation games, cattle billboards, hand-washing elephants, and more.

**Other Exhibitor**

### 7) Poop Games: Using technology and design to improve sanitation

*Hattery Labs LLC*

*USA*

Demonstration of mobile games that promote the safe use of sanitation facilities and handwashing; and highlights of a social media campaign that uses fun and positive emotions to demystify the act of using the toilet. Fair participants will be able to be among the first people to join the campaign online and participate actively in raising awareness around using safe latrines.

**Other Exhibitor**

### 8) An energy-producing, waterless toilet system

*Loowatt Ltd*

*United Kingdom*

A waterless toilet that seals waste into a portable cartridge within biodegradable film for anaerobic digestion. The digester unit produces fuel and fertilizer, creating valuable resources and business opportunities.

**Grand Challenge Explorations Grantee**

### 9) A high-efficiency sanitary toilet with sewage treatment

*Livvon LLC*

*USA*

A simple toilet with integrated sludge treatment that employs a hand crank to desiccate feces and turn them into dry, odorless pellets that can be used for fertilizer or fuel. The airtight system is designed to control odor and keep out flies and vermin.

**Grand Challenge Explorations Grantee**

### 10) A self-mixing biogas generator

*Frontier Environmental Technology*

*USA*

A biogas generator that employs a unique, self-sustaining mixing mechanism to effectively treat concentrated wastewater and produce biogas without the typical amount of energy used for mechanical mixing or the need for trained personnel.

**Grand Challenge Explorations Grantee**

### 11) Developing fortified fertilizer pellets from human waste

*International Water Management Institute*

*Ghana*

Fertilizer pellets that are created from a mix of treated human excreta and organic solids, with a prolonged shelf life to withstand transportation over long distances. The process will be designed for production at large scale for use in agriculture in sub-Saharan Africa while also contributing to a reduction in environmental health risks from untreated human waste.

**Grand Challenge Explorations Grantee**

### 12) Sewage Containment and Mineralization device (SeCoM)

*Institute for Residential Innovation (IResI)*

*USA*

A compact, stand-alone device that uses a nonmicrobial system of progressive reactor modules to mineralize biomass, such as sewage and food waste, and to simultaneously generate electrical power. This system will be designed for use in any location to provide sanitation and purified water.

**Grand Challenge Explorations Grantee**

### 13) Tiger Toilet and Black Soldier Fly Larvae System “The Kone”

*London School of Hygiene and Tropical Medicine*

*United Kingdom*

A worm-based on-site sanitation system that is more compact and affordable than septic tanks.

**Other Exhibitor**

### 14) Bioelectric Toilet

*University of Colorado, Denver*

*USA*

An easy-to-operate bioelectric system that uses locally sourced materials and indigenous microbes to break down waste and convert it to usable electricity. This technology will be designed to provide a self-sustainable solution for communities in need of both sanitary waste disposal and an energy supply.

**Grand Challenge Explorations Grantee**

## About the Bill & Melinda Gates Foundation’s Water, Sanitation & Hygiene Initiative

The foundation’s Water, Sanitation & Hygiene (WSH) team is working with partners to develop sustainable sanitation services that work for everyone, including the poor.

The Reinvent the Toilet Fair showcases some exciting investments in science and technology. These grants are funding innovations in a range of improved toilet technologies—based on fundamental engineering processes—for the safe and sustainable management of human waste.

Technology is not the only thing that is needed to meet the sanitation challenge. Behavior change and encouraging markets and governments to provide sanitation products and services to those in need must also be part of the solution. Our policy and advocacy work encourages sanitation policies and investments that work for the poor. We focus our efforts in sub-Saharan Africa and South Asia, where the burden of unsafe sanitation is greatest.

## Exhibitors

### 15) Developing chemicals to self-clean and disinfect toilets

*American Environmental Systems Inc.*

*USA*

Low-cost, durable chemicals (silicones) that will be impregnated with photoactive metal nanoparticles to create a coating on toilets to make them self-cleaning and antimicrobial.

**Grand Challenge Explorations Grantee**

### 16) Modeling the next generation of sanitation systems

*University College, London*

*United Kingdom*

A simulation tool designed to be used in developing countries to evaluate new sanitation technologies. By including parameters such as pit latrines served, distance to treatment, and potential for energy recovery, the simulation tool can aid communities in determining the best new systems for local needs.

**Grand Challenge Explorations Grantee**

### 17) A toilet that converts human waste to fuel gas

*Delft University of Technology*

*The Netherlands*

A toilet system that applies microwave technology to transform human waste into electricity. The waste will be gasified using a microwave-induced plasma. This process will yield synthesis gas (syngas), a mixture of carbon monoxide and hydrogen. The syngas will then be fed to a solid oxide fuel-cell to generate electricity.

**Reinvent the Toilet Challenge Grantee**

### 18) The Microflush Biofil Toilet

*Participating organizations: Ghana Sustainable Aid Project and Biofilcom Ltd*

*USA*

A single-family toilet facility that uses aerobic digestion to decompose waste. It incorporates a simple water-sealed valve that eliminates smell and flies. The water seal is created from the water used by the previous occupant while washing hands. The project includes field testing and evaluation of cultural, financial, and sanitation factors related to the facilities.

**Grand Challenge Explorations Grantee**

### 19) Diversion for safe sanitation

*Participating organizations: Eawag: Swiss Federal Institute of Aquatic Science and Technology; EOOS*

*Switzerland*

A functional model of a urine-diverting toilet that recovers water for flushing. The urine and feces will be safely transported to a decentralized processing center. The water used for cleaning will be recycled by a gravity-driven biological membrane.

**Reinvent the Toilet Challenge Grantee**

### 20) A community bathroom block that recovers clean water, nutrients, and energy

*University of Kwazulu-Natal*

*South Africa*

A toilet system that can safely dispose of pollutants and recover materials such as water and carbon dioxide from urine in community bathroom blocks. The system will separate the urine from the feces and extrude the feces into thin strands for faster drying and stabilization.

**Reinvent the Toilet Challenge Grantee**

### 21) A toilet that produces biological charcoal, minerals, and clean water

*Loughborough University*

*United Kingdom*

A toilet that transforms feces into a biological charcoal (biochar) through hydrothermal carbonization (decomposition at high temperatures without oxygen and in water) of fecal sludge. The proposed system will be powered from heat generated by combusting the produced biochar and will be designed to recover water and salts from feces and urine.

**Reinvent the Toilet Challenge Grantee**

### 22) A device that sterilizes fecal sludge

*Oklahoma State University*

*USA*

A small-scale device in which an auger forces feces and other solid wastes through a die, resulting in a temperature and pressure that are high enough to remove water and destroy pathogens.

**Grand Challenge Explorations Grantee**

### 23) The Earth Auger Toilet: Innovation in waterless sanitation (el taladro de la tierra)

*Fundación In Terris*

*Ecuador*

A composting toilet in which feces and urine are mechanically removed after each use. The toilet is designed as a pedal-operated, low-cost, easy-to-use, odorless, urine-diverting system. Dry material will be mixed in mechanically, and the end product becomes plant fertilizer.

**Grand Challenge Explorations Grantee**

### 24) A toilet that sanitizes feces and urine to recover resources and energy

*University of Toronto*

*Canada*

A technology for treating solid waste streams through mechanical dehydration and smoldering (low-temperature, flameless combustion) that will sanitize feces within 24 hours. Urine will be passed through a sand filter and disinfected with ultra-violet light.

**Reinvent the Toilet Challenge Grantee**

### 25) Safe sludge project

*University of California, Berkeley*

*USA*

A process for disinfecting fecal sludge in latrines by converting the ammonia naturally found in urine and feces into a powerful disinfectant with an alkaline additive that will raise the pH level. By killing pathogens immediately and turning waste into "safe sludge," all subsequent activities required for fecal sludge management can become safer.

**Grand Challenge Explorations Grantee**

### 26) A vortex bioreactor that processes fecal sludge and wastewater

*Plymouth Marine Laboratory*

*United Kingdom*

A low-cost, vortex-based bioreactor that is driven by hand or bicycle to separate fecal matter from wastewater and introduce bactericidal agents to decontaminate the waste for recycling or safe disposal.

**Grand Challenge Explorations Grantee**

### 27) A device to improve pit latrine emptying

*North Carolina State University*

*USA*

An inexpensive method for emptying cesspits and wet latrines that uses gasoline-powered augers modified to operate as a type of screw pump for filling drums and other containers.

**Grand Challenge Explorations Grantee**

### 28) A urine-diverting combustion toilet

*National University of Singapore*

*Singapore*

A toilet that uses biological charcoal (biochar) to dry and combust feces. The heat generated will be used to extract water from urine by boiling it under pressure. The system can be fitted with activated carbon and exchange resin to recover highly purified water.

**Reinvent the Toilet Challenge Grantee**



## Exhibitors

### 29) Urban sanitation solutions for high-use, flooded, and difficult-to-serve areas

*Fontes Foundation*

*Norway/Haiti*

A new modular, knock-down toilet block system that can be erected in high-density, difficult-to-serve communities. The system is designed to feature urine-diverting toilet pans, as well as enlarged ventilation areas that could eliminate odors and desiccate feces. The toilets will use recycled billboard fabric as waterproof walls, ceilings, and bladders to safely store fecal sludge that could otherwise contaminate water supplies.

**Grand Challenge Explorations Grantee**

### 30) A solar-powered toilet that generates hydrogen and electricity

*California Institute of Technology*

*USA*

A self-contained, solar-powered toilet and wastewater treatment system. A solar panel will produce enough power for an electrochemical reactor that is designed to break down water and human waste into hydrogen gas. The gas can then be stored for use in hydrogen fuel cells to provide a backup energy source for nighttime operation or use under low-sunlight conditions.

**Reinvent the Toilet Challenge Grantee**

### 31) Converting human waste to biological charcoal

*re:char*

*USA*

Low-cost pyrolysis reactors that convert human waste into biological charcoal (biochar), which can be used as a replacement for wood charcoal or chemical fertilizers. Assessment will be made of the income-generating potential of the produced biochar.

**Grand Challenge Explorations Grantee**

### 32) A wind-driven sanitation system

*Southern Illinois University*

*USA*

A wind turbine-driven sanitation system that raises and maintains temperatures in an insulated container that removes pathogens in human waste. The technology will be designed for use in temperate or equatorial zones to reduce the occurrence of diarrheal diseases. This decentralized system is intended for 20 to 50 people.

**Grand Challenge Explorations Grantee**

### 33) On-site fecal sludge extraction and disposal system

*Shijiazhuang University of Economics*

*China*

A waste extraction and disposal system that uses wind or solar power to pull waste from septic tanks or cesspools up a tube that is exposed to sunlight. The solar heating kills all pathogens and reduces waste volume. This system will be designed to be durable and low maintenance, allowing for rapid on-site waste disposal.

**Grand Challenge Explorations Grantee**

### 34) A solar steam sterilizer to treat human waste

*Rice University*

*USA*

A prototype sterilizer that employs metallic nanoparticles to absorb solar energy and convert water to steam that can sterilize human waste.

**Grand Challenge Explorations Grantee**

### 35) A sanitation system that converts human waste into biological charcoal

*Participating organizations: Stanford University and the Climate Foundation*

*USA*

A self-contained system that pyrolyzes (decomposes at high temperatures without oxygen) human waste into biological charcoal (biochar). After the fair, the system will be shipped to Nairobi to process two tons of human waste daily, at a facility located in the slums.

**Reinvent the Toilet Challenge Grantee**

Guided by the belief that every life has equal value, the Bill & Melinda Gates Foundation works to help all people lead healthy, productive lives. In developing countries, it focuses on improving people's health and giving them the chance to lift themselves out of hunger and extreme poverty. In the United States, it seeks to ensure that all people—especially those with the fewest resources—have access to the opportunities they need to succeed in school and life. Based in Seattle, Washington, the foundation is led by CEO Jeff Raikes and Co-chair William H. Gates Sr., under the direction of Bill and Melinda Gates and Warren Buffett.

**For additional information on the Bill & Melinda Gates Foundation, please visit our website: [www.gatesfoundation.org](http://www.gatesfoundation.org).**

© 2012 Bill & Melinda Gates Foundation. All Rights Reserved. Bill & Melinda Gates Foundation is a registered trademark in the United States and other countries.