

WATER, SANITATION & HYGIENE: REINVENT THE TOILET CHALLENGE

FACT SHEET

OVERVIEW

In 2011, the Water, Sanitation & Hygiene program initiated the Reinvent the Toilet Challenge to bring sustainable sanitation solutions to the 2.5 billion people worldwide who don't have access to safe, affordable sanitation.

These grants have been awarded to researchers around the world who are using innovative approaches—based on fundamental engineering processes—for the safe and sustainable management of human waste. In addition to these Reinvent the Toilet Challenge (RTTC) grants, we have made a range of other investments that are aligned with reinventing the toilet, and we are continuously seeking to expand our partnerships on this challenge.

The Reinvent the Toilet Challenge aims to create a toilet that:

- 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, or electrical lines.
- Costs less than US\$.05 cents per user per day.
- Promotes sustainable and financially profitable sanitation services and businesses that operate in poor, urban settings.
- Is a truly aspirational next-generation product that everyone will want to use—in developed as well as developing nations.

REINVENT THE TOILET CHALLENGE GRANTS

2011 Grants

California Institute of Technology, USA

To develop 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. Excess power can be stored to provide energy for nighttime operation or for use under low-sunlight conditions.

Delft University of Technology, The Netherlands

To develop a toilet system that uses microwave technology to transform human waste into electricity. The waste will be gasified, yielding synthesis gas (syngas), which will then be fed to a solid oxide fuel cell to generate electricity.

Eawag: Swiss Federal Institute of Aquatic Science and Technology, and E00S, Switzerland

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

Loughborough University, United Kingdom

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

National University of Singapore, Singapore

To develop a toilet that uses 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.

Stanford University and the Climate Foundation, USA

To develop a self-contained system that pyrolyzes (decomposes at high temperatures without oxygen) human waste into biochar. Energy recovered from the biochar production process will be used for heating the system.

University of Kwazulu-Natal, South Africa

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

University of Toronto, Canada

To develop a toilet that uses a technology for treating solid waste streams through mechanical dehydration and smoldering (low-temperature, flameless combustion) that will dispose of the waste within 24 hours. Urine will pass through a sand filter and be disinfected with ultraviolet light.

2012 Grants

Cranfield University, United Kingdom

To develop a toilet that removes water from human waste and vaporizes it using a hand-operated vacuum pump and a unique membrane system. The remaining solids will be turned into a safe-to-handle material that can also be used as fertilizer. The water vapor will be condensed and sanitized so it can be used for washing or irrigation.

Eram Scientific Solutions Private Limited, India

To make public toilets more accessible to the urban poor via the eco-friendly and hygienic “eToilet.” The stand-alone toilet is automatically cleaned after each use and that water is recycled for flushing the toilet. The eToilet can be maintained and operated remotely by computer, improving cleanliness, service quality, and consistency.

RTI International, USA

To develop a self-contained toilet system that disinfects liquid waste and turns solid waste into fuel or electricity through a novel biomass energy conversion unit.

University of Colorado Boulder, USA

To develop a solar toilet that uses concentrated sunlight, directed and focused with a solar dish and concentrator, to disinfect liquid-solid waste and produce biochar that can be used as a replacement for wood charcoal or chemical fertilizers.

2013 Grants

Unilever PLC, United Kingdom

To advance the application of pyrolysis technology at communal toilet sites, a process suited to decompose human waste at high temperatures to produce electricity and biochar.

Duke University, USA

To develop, build, and evaluate a novel technique to treat fecal sludge using supercritical water oxidation, a process in which water is heated under pressure and then oxygen is added to burn up human waste. The reaction produces clean water, heat, carbon dioxide, benign salts, and nitrogen, all of which can be used by the community or turned into business opportunities.

Santec LLC, USA

To develop an electric toilet, powered by solar power stored in batteries, that will separate liquids from solids and dewater and convert fecal matter into biochar. This approach examines using resistive heating through battery-stored solar power and is designed from existing off-the-shelf components.

Regional Focus on Southeast Asia Grant

The Asian Institute of Technology (AIT), Thailand

To develop and commercialize novel, improved decentralized sanitation systems for the poor, particularly in urban areas. In addition to technology development, the project aims to create viable and scalable businesses.

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.

© 2013 Bill & Melinda Gates Foundation. All Rights Reserved. Bill & Melinda Gates Foundation is a registered trademark in the United States and other countries.