
# SUSTAINABLE NON-SEWERED SANITATION TECHNOLOGIES

# – NO FLUSH, NO SEWER -

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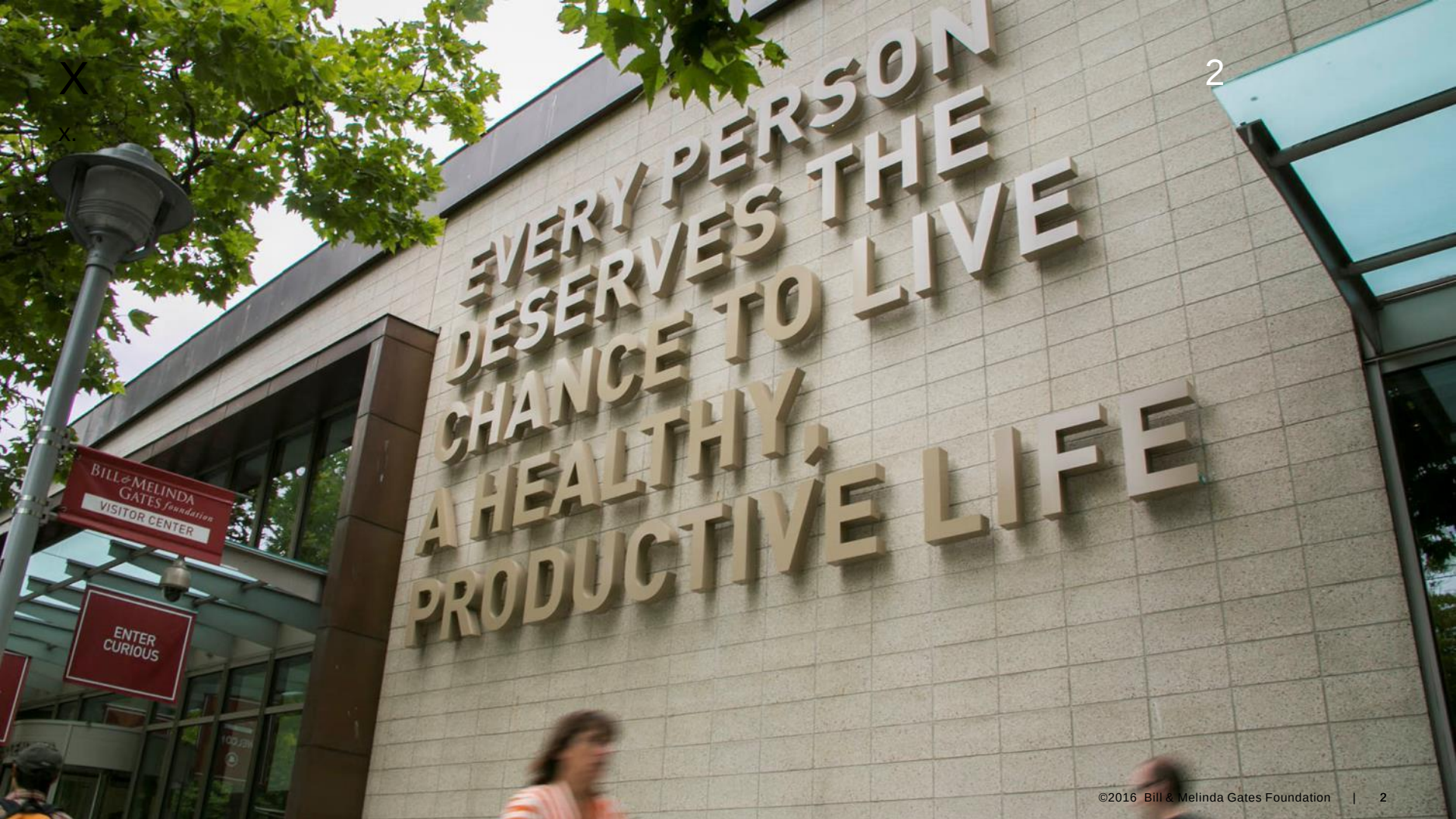
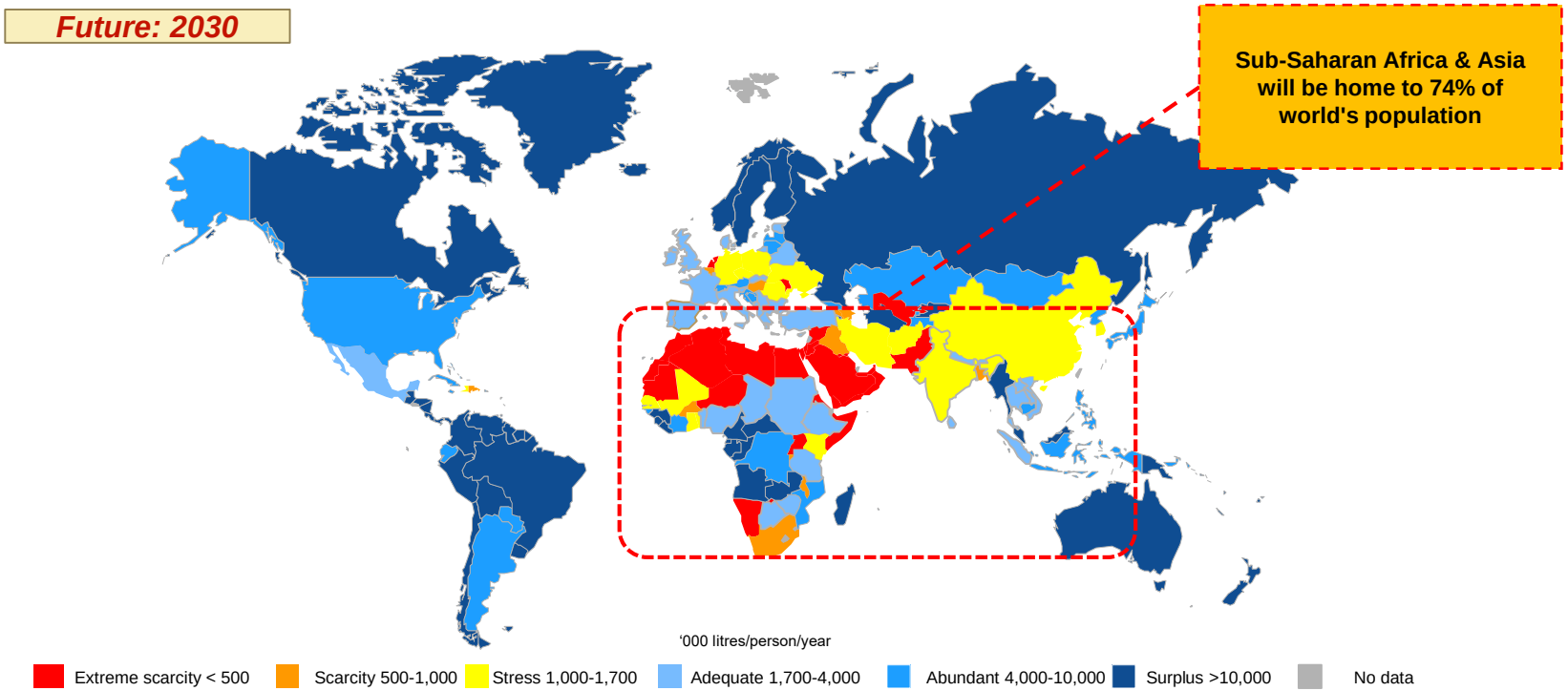


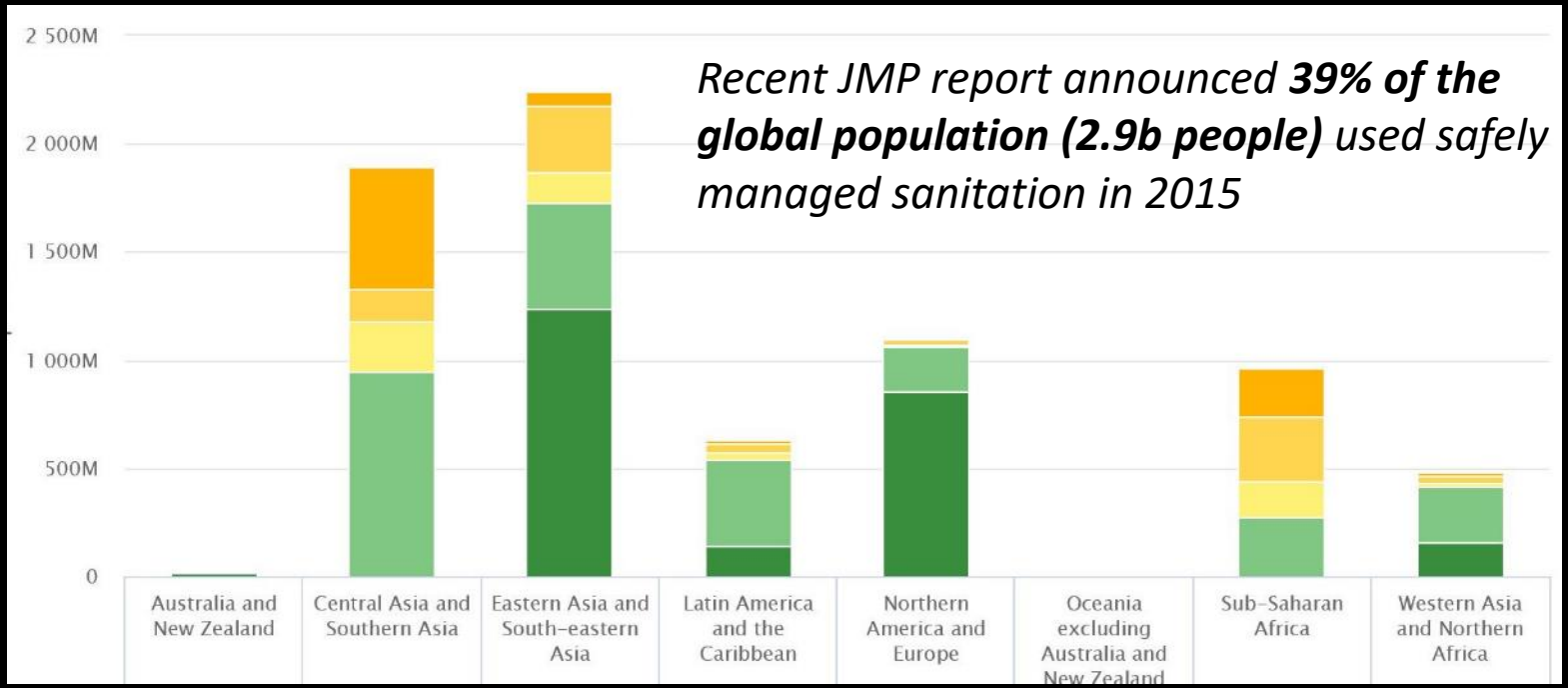
# WATER SCARCITY WILL MAKE FECAL SLUDGE MANAGEMENT EVEN MORE IMPORTANT

***Future: 2030***




1. United Nations environment programme
Source: 'Global Water Initiative' (June 2005), GEF International Waters Conference, The Coca-Cola Company, Grail Research, BCG Analysis




*Recent JMP report announced **39% of the global population (2.9b people)** used safely managed sanitation in 2015*

**JMP 2017**

- Some 3 in 10 people worldwide, or **2.1 billion**, lack access to safe, readily available water at home,
- 6 in 10, or **4.4 billion**, lack safely managed sanitation, (WHO) and UNICEF 2017)
- **Only 11% of urban Sub-Saharan Africa is connected to sewers in 2015, down from 13% in 2000**

# Birthing a sanitation industry – reinvent the toilet

Fix an important market failure by delivering services and product that meet customers needs and aspiration, compatible with 21st century technologies

# THE REINVENTED TOILET PROGRAM IS DESIGNED TO ADDRESS EACH OF TODAY'S LIMITATIONS

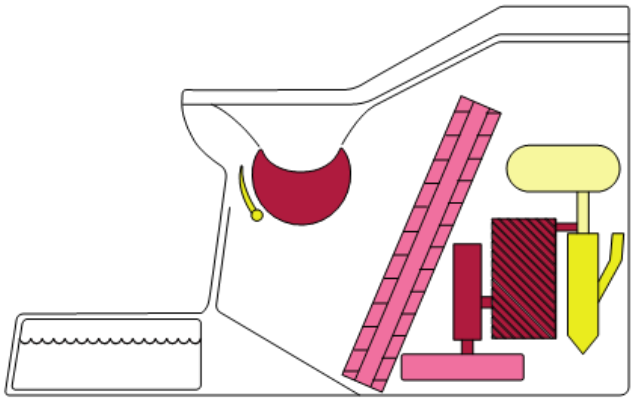
The Reinvented Toilet is a modular, transformative technology that offers a non-sewered sanitation solution, eliminating the need for a piped collection system. The aim of the Reinvented Toilet is to: destroy all pathogens onsite and recover valuable resources, operate without sewer, water or electricity connections and cost less than $0.05/user/day in a sustainable business model.

## ELIMINATE PATHOGENS

- Eliminate safety concerns via handling
- Reduce disease burden
- Improve environmental safety

## OPERATE OFF GRID

- Eliminate need for external inputs such as water and energy
- Make portable and easy to install



## CONVEY LOW LIFE-CYCLE COSTS

- Reduce need for pit emptying
- Ensure a sustainable business model, including maintenance via service providers

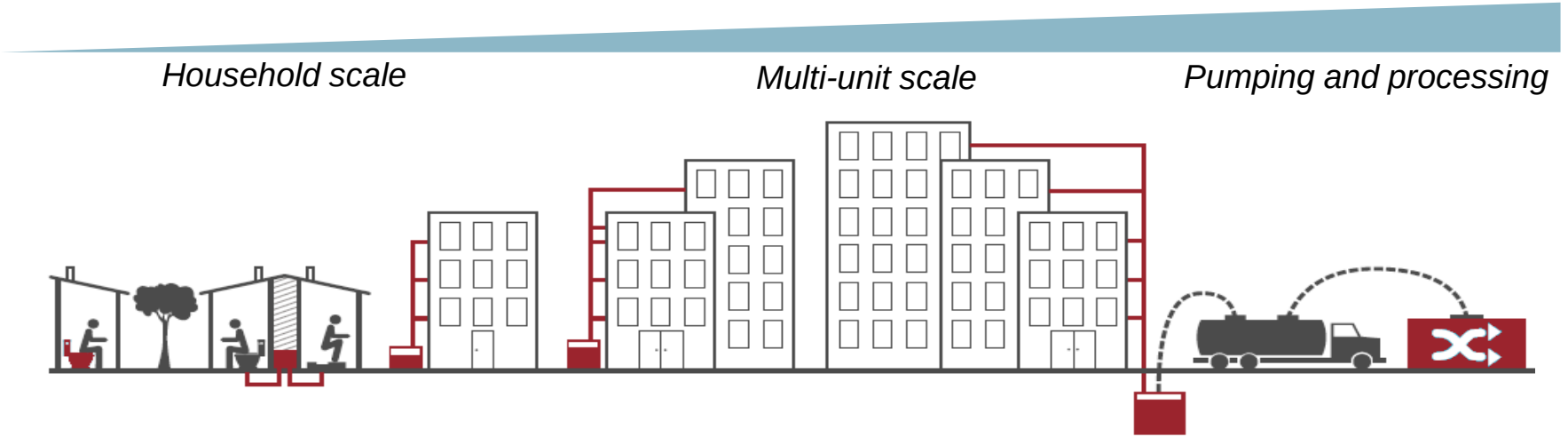
## PRESENT MODULAR, ATTRACTIVE INTERFACE

- Reduce / eliminate construction costs
- Provide clean and dignified product
- Eliminate odors and waste

# THE REINVENTED TOILETS ARE NON-SEWERED SANITATION SYSTEMS FOR A RANGE OF USE CASES

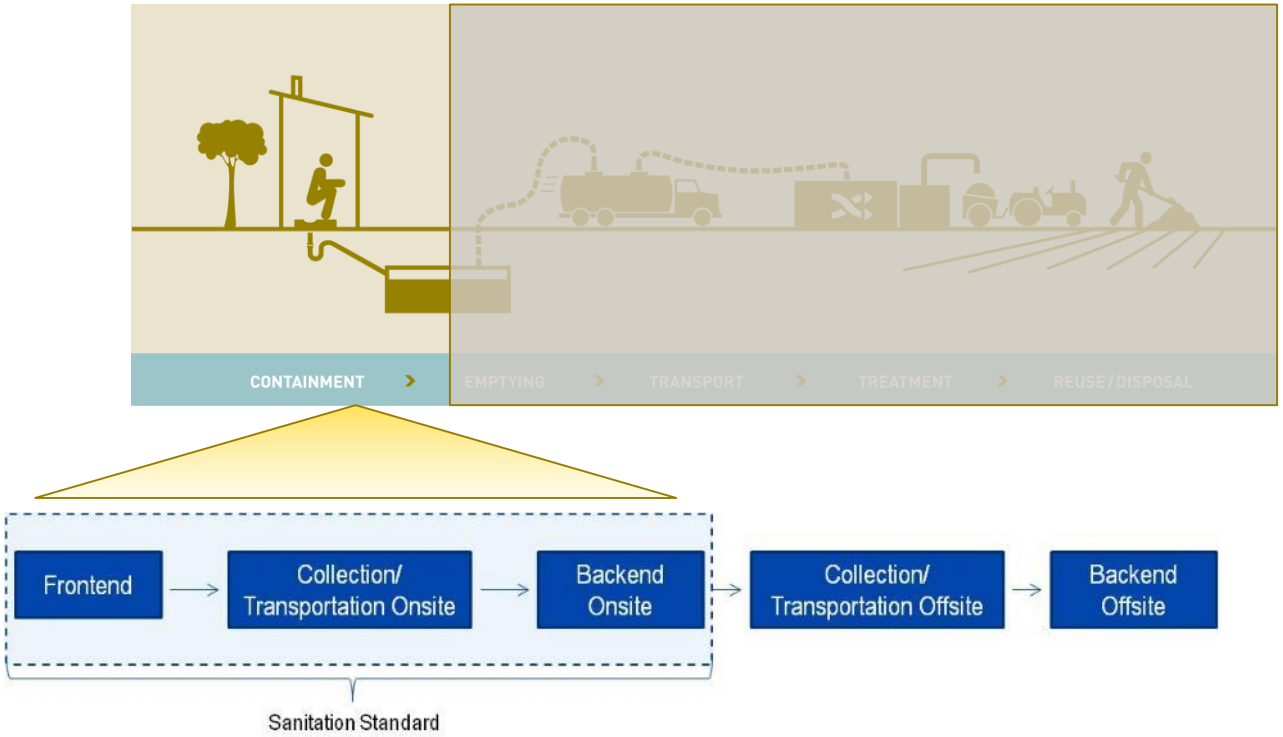
From household systems that can be used inside the home, to external units that process waste from multiple dwellings or apartment units, the RT portfolio includes technologies for a range of use cases, with varying sizes and capacities.

## RT SUPPORT A RANGE OF USE CASES, SIZES, CAPACITIES



# DEFINING THE RULES AND SPECS TOGETHER: STANDARDS DEVELOPMENT (ISO/PC305)



INTERNATIONAL WORKSHOP AGREEMENT

**IWA 24**

First edition
2016-09-01

# Non-sewered sanitation systems — General safety and performance requirements for design and testing

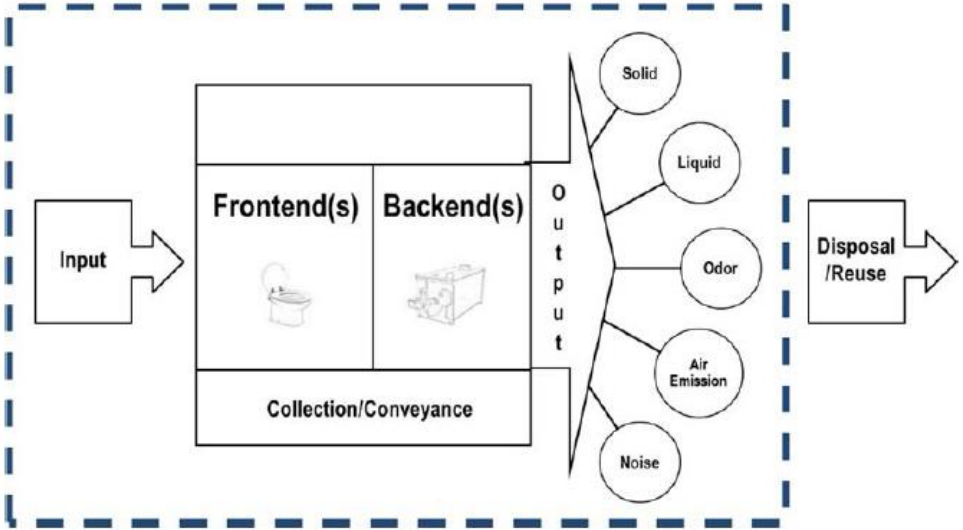
*Systèmes d'assainissement non collectifs — Exigences de performance et de sécurité générale pour la conception et les essais*

Reference number
IWA 24:2016(E)



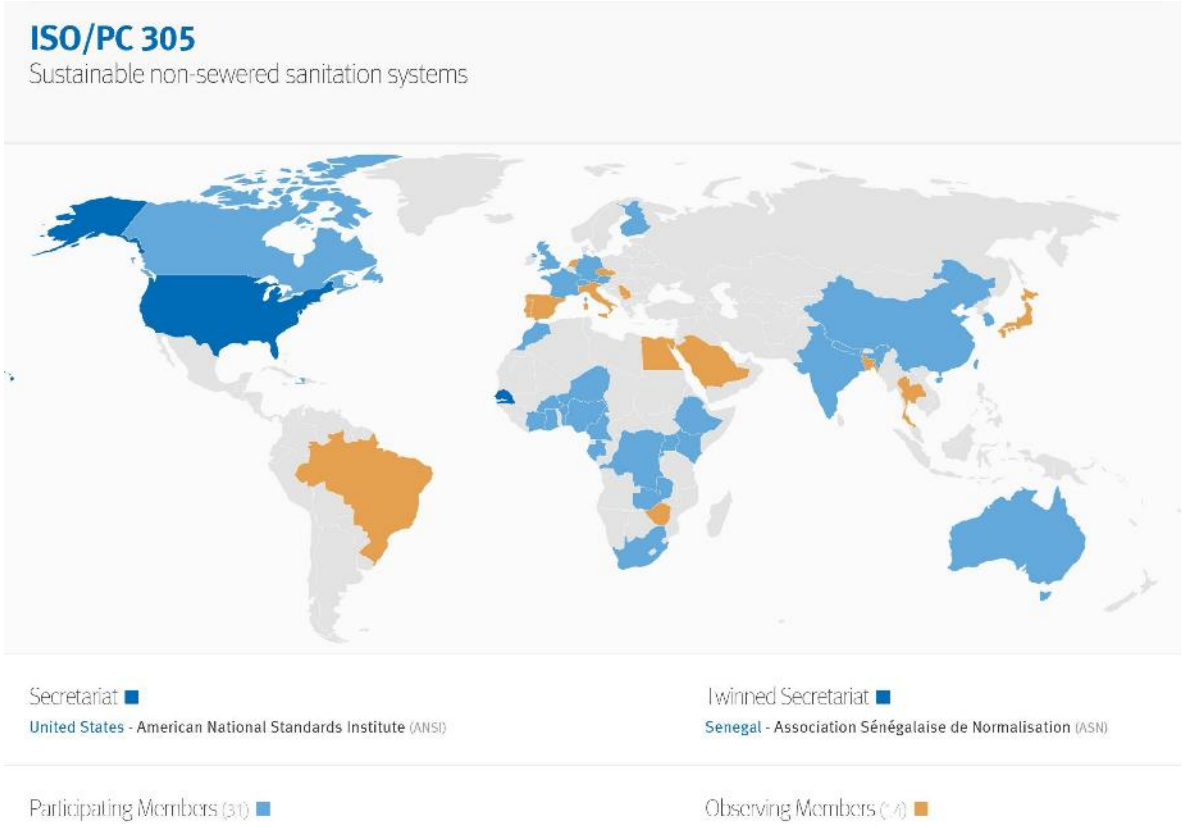


## SCOPE OF THE STANDARD



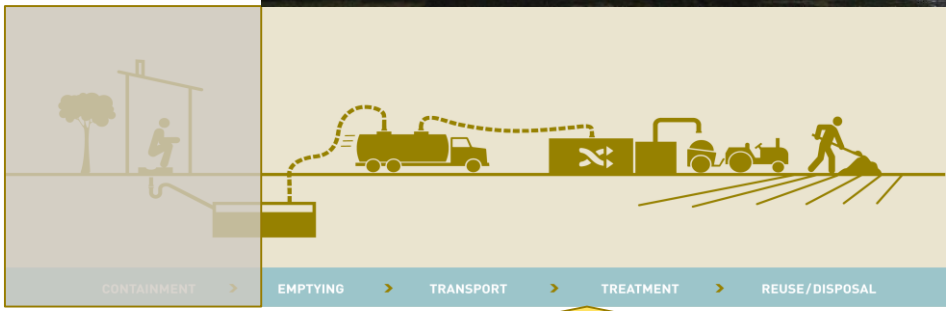
# NON-SEWERED SANITATION SYSTEM STANDARD: COUNTRY PARTICIPATION

- **44 Countries involved in the development of the standard**
- **30 participating**
- **14 observing**



# FSM STANDARD PUBLISHED 9/2016: ISO 24251


Sope of FSM Standard, ISO 24251

INTERNATIONAL STANDARD

**ISO 24521**

First edition
2016-09-01

## Activities relating to drinking water and wastewater services — Guidelines for the management of basic on-site domestic wastewater services

*Activités relatives aux services de l'eau potable et des eaux usées — Lignes directrices pour la gestion sur site des services d'eaux usées domestiques de base*



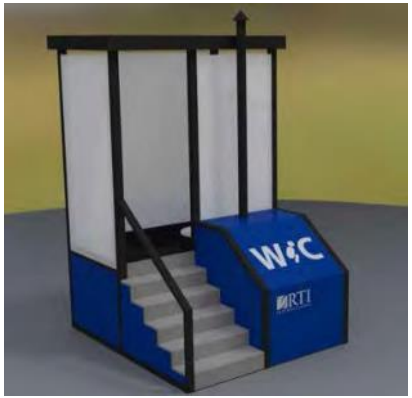
Reference number
ISO 24521:2016(E)

# FECAL SLUDGE REUSE

## JANICKI OMNI PROCESSOR S200

## FS BIOGAS PLANT - OUAGADOUGOU

# TOILETS THAT KILL PATHOGENS, TURN FECES/URINE INTO COMMODITY AND OPERATES WITHOUT SEWER, WATER CONNECTION




# EXAMPLE OF CORE PROCESSING TECHNOLOGIES FOR TOILETS THAT KILL PATHOGENS. NO SLUDGE, NO SEWER, NO FLUSH

## ELECTROCHEMICAL

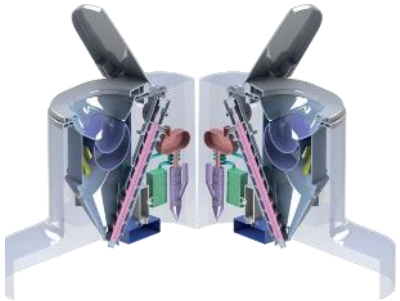
Caltech

## WET OXIDATION

Loughborough University

eawag aquatic research

## DRY COMBUSTION



University of Toronto

Cranfield University

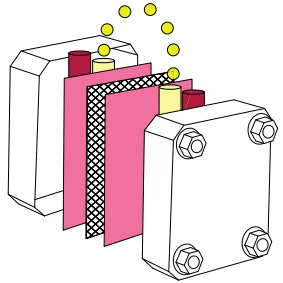
Duke University

RTI International

Three Bird Swan Consulting Group

JANICKI BIOENERGY

## BIOLOGICAL



USF University of South Florida

UWE Bristol

# THE CALTECH TOILET TREATS AND RECYCLES WASTEWATER FOR REUSE AS FLUSHING WATER.

| | |
|---|---|
| Capacity | Up to 500 users per day |
| Key Features | • Unique **electrochemical process** treats urine and wastewater and produces hydrogen<br>• Residual chlorine guarantees the **safety of the recycled wastewater** for flush reuse.<br>• Compatible with **any type of flush toilets** (squat pan, western style, etc.) |
| Current Status | Partnered with The Kohler Company and Eco-San to develop optimized versions of the system for commercialization. |
| IP Status | Patent pending in the United States, India, and China. See WO 2014/058825 A1 for further information. |
| Links | http://hoffmann.caltech.edu/ |

# THE LOUGHBOROUGH TOILET IS A BACKEND PROCESSING UNIT SIMILAR TO A PRESSURE COOKER.

| | |
|---|---|
| Capacity | Estimated 6 to 40 users/day. Future larger versions could serve more than 100 users per day. |
| Key Features | • System is designed to be **compact**, for deployment in a home<br>• A unique **hydrothermal carbonization** process sanitizes urine and feces without the need for separation<br>• Produces approximately 10-15 g/user/day of biochar and liquor that can be used as **fertilizer**<br>• Char has a calorific value similar to lignite and can be used for carbon capture<br>• Estimated to be energy positive, generating ~1.2 kWh/user/day |
| Current Status | Functional, field tested prototype |
| IP Status | In process |
| Links | |

# AUTARKY COMBINES A SPECIALLY DESIGNED FRONTEND WITH NOVEL BACKEND TREATMENT PROCESSES.

*Source: © Eawag/ EOOS*

| | |
|---|---|
| Capacity | Still in development. |
| Key Features | • Attractive frontend developed through extensive user testing with design firm partner, EOOS<br>• Unique backend processing systems for both liquids and solids<br>• Produces fertilizer: phosphate- and nitrogen-based |
| Current Status | Components have been proven at lab scale. Component optimization, scale-up, and system integration is ongoing. |
| IP Status | Patent protection on the frontend of the device is being pursued by EOOS. See WO 2014/022873 A2 for more information. |
| Links | http://www.bluediversiontoilet.com/ |

# THE NANOMEMBRANE TOILET IS A 100% SELF-CONTAINED HOUSEHOLD TOILET – NO EXTERIOR WATER OR POWER NEEDED.

| | |
|---|---|
| Capacity | 10 users/day (potential for larger capacity) |
| Key Features | • **System design** is completely self-contained, no water or power connections are required<br>• **Unique waterless flush system** minimizes water requirements<br>• **Heat from the gasification process** is used to increase filtration efficiency<br>• System produces **surplus power and potable water** each day for household use<br>• Ash requires regular disposal |
| Current Status | Working on system component integration in preparation for field testing. |
| IP Status | Multiple filed but not yet published. |
| Links | http://www.nanomembranetoilet.org/ |

# THE DUKE/ RTI TOILET GENERATES ENERGY FROM SOLID COMBUSTION AND TREATS AND RECYCLES LIQUID FOR FLUSHING.

| | |
|---|---|
| Capacity | Approximately 10-50 users per day |
| Key Features | • **Frontend** is pleasant to use and safe<br>• Liquids are process via **pulsing electrochemical disinfection**<br>• Solids are **dried** and prepared as **pelletized fuel** for combustion<br>• Thermal energy from combustion process converted to electricity to drive liquid disinfection<br>• **Independent solid and liquid processing streams** that can be used as modules and paired with other technologies |
| Current Status | Field testing underway in Ahmedabad, beta prototype update in process for deployment |
| IP Status | Disclosures prepared; no patent protection has been filed. |
| Links | http://abettertoilet.org/ |

# THE MICROBIAL FUEL CELL (MFC) PROCESSES URINE TO GENERATE ELECTRICITY.

| | |
|---|---|
| Capacity | Scalable since cell size may vary and multiple cells can be integrated together. |
| Key Features | • System design is a small, cubicle cell.<br>• System produces electricity via breakdown of microbes and organic compounds in urine.<br>• System is scalable to treat large or small volumes of urine. |
| Current Status | Lab results have shown that 1mW can be generated from a 10mL-MFC. Field testing has shown that integrated groups of MFCs are robust and can process small volumes (1-2 users per week at a university) or large volumes (many users at a music festival) of urine effectively. |
| IP Status | Patent pending in the United States, Great Britain, China, and Japan, with additional EU designation pending. See US 2014/0057136 A1 for addtional detail. |
| Links | http://www.brl.ac.uk/researchthemes/bioenergyself-sustaining.aspx |

# Thank you