Approaches to improve Water Supply, Sanitation and Hygiene in low-income countries

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The ETH Domain and Eawag's Mandate

Federal Department of Economic Affairs, Education and Research (EAER)

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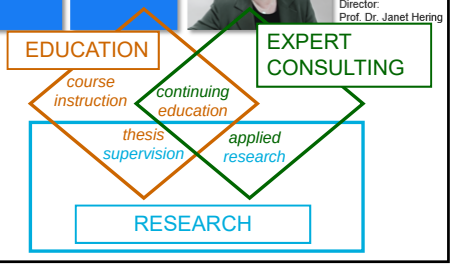


Eawag, Swiss Federal Institute of Aquatic Science & Technology

Main fields of activity

- Water for health and well-being
- Water for ecosystems
- Strategies to deal with conflicts of interest in relation to water

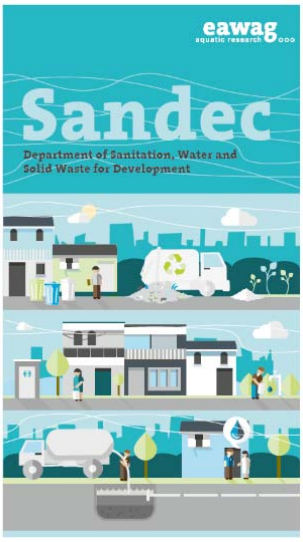
Staff

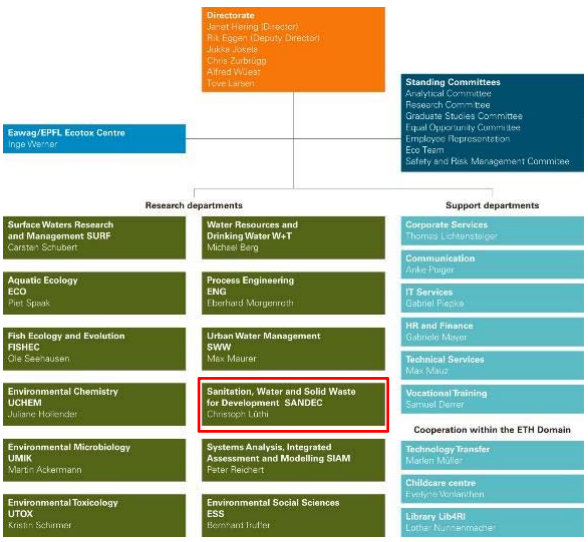
- 320 scientists incl. 100 doctoral students
- 160 technical and admin staff
- 27 apprentices

Subject areas of researchers

70% natural sciences
25% engineering sciences
5% social sciences

Sandec, Dept. Sanitation, Water and solid Waste for Development





Sandec Objectives

- Generating knowledge through research.
- Developing and facilitating the implementation of new concepts and technologies in water supply, environmental sanitation, and excreta, wastewater and solid waste management.
- Increasing research capacity and professional expertise on water supply and environmental sanitation in low and middle income countries.
- Advocating to make water supply, environmental sanitation and solid waste a priority in low and middle income countries.




Sandec's Research Groups


Strategic Environmental Sanitation Planning


Excreta and Wastewater Management


Municipal Solid Waste Management


Water Supply and Treatment


Safe Water Promotion

Background – The Global Challenge

The **poor are disproportionately most affected** by inadequate WASH

- 2.1 billion people do not use safely managed drinking water service (located on premises, available when needed, free from contamination)
- 844 million people still lack even a basic drinking water service
- 2.3 billion people still lack even a basic sanitation service
- In Least Developed Countries, 47% of the population has no facility to wash hands. 26% have facilities that lack soap or water.

- 842 000 deaths are caused by inadequate WASH per year
- 361 000 diarrhoeal deaths among children under-five of these deaths, or over **1000 child deaths per day** are caused by inadequate WASH

UN General Assembly resolution, July 2010

"recognizes the right to safe and clean drinking water and sanitation as a **human right"**

Criterion	UN Human Rights Council 2010
Sufficient quantity	Availability
Continuity of service	
Safe for health	Quality/safety
Aesthetically acceptable	Acceptability
Time/distance required to collect	Accessibility
Suitable for use by all, including young, old, disabled, etc	
Affordable	Affordability

Sustainable development goals

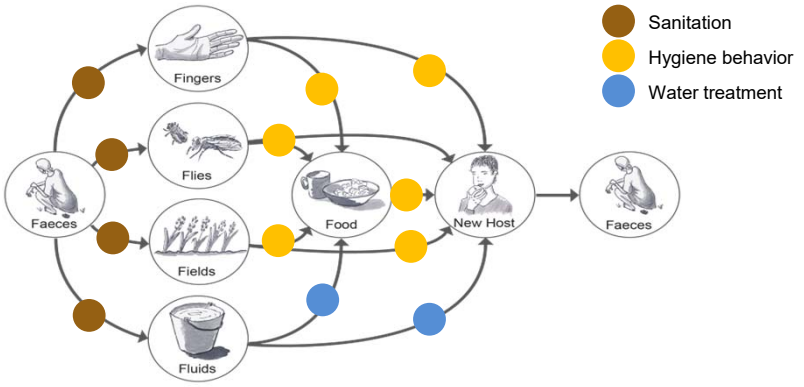
Sustainable Development Goal (SDG) global targets:
- Ending **open defecation** (SDG 6.2)
- Achieving universal access to **basic services** (SDG 1.4)
- Progress towards **safely managed services** (SDG targets 6.1 and 6.2).

Service level	Water	Sanitation
Safely managed	• Located on premises • Available with needed • Free from contamination	• Private improved facilities • Safe disposal of excrety
Basic	• From improved source • Collection time <30 Min (↔)	• Private improved facilities
Limited	• From improved source • Collection time >30 Min (↔)	• Shared improved facilities
Unimproved	• From unprotected dugwell or spring	• Pit latrines without slab or platform
Surface water/ Open defecation	• From river, dam, lake, pond, stream, canal	• Disposal of faeces in open environment

Note: improved facilities

Water	Sanitation
Improved sources include: • *piped water* • *boreholes* • *tubewells* • *protected dug wells* • *protected springs* • *packaged or delivered water*	*improved facilities include:* • *flush/pour flush to piped sewer systems, septic tanks or pit latrines* • *ventilated improved pit latrines* • *composting toilets* • *pit latrines with slabs*

Routes of fecal disease transmission & protective barriers



Improved WaSH in Eastern Uganda

Community around Lake Victoria consumes water directly from the lake
- ► health risks

In collaboration with a local NGO

Evalution of:

- ➢ Innovate technology for drinking water treatment in school and communities
- ➢ WaSH lessons in schools (safe water school manual) & training in community

Local capacity building

Eawag Sandec
- Technical support (Installation water treatment)
- Training of trainers, capacity building
- Evaluation
- Supervision & Quality control (project)

Local NGO
- Training
- Technical installation
- Supervision & Quality control

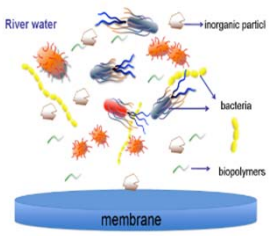
Nalwire Technical Institute Uganda
- Technical installation
- Maintenance & Repairs

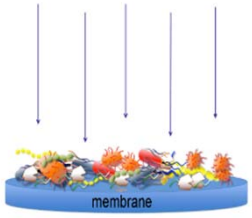
Teachers
- WASH lessons in school
- Daily practice

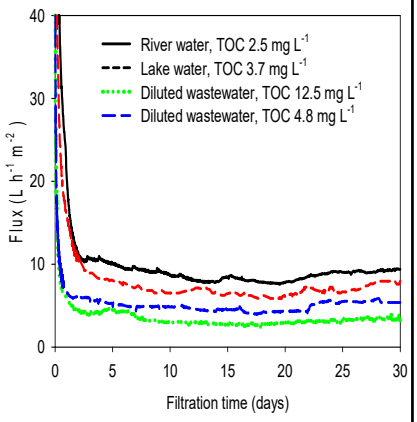
Community
- WASH training
- Management body

Kiosk management & operator
- Operation & maintenance
- Business mgt.

Gravity-driven membrane technology





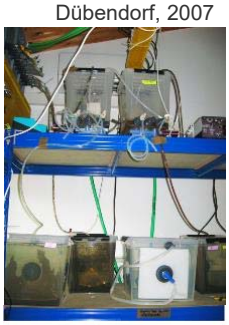


- Particulate and dissolved material deposits on membrane
- Thickness of the layer increases in time

Flux stabilizes on a level of 2-10 (L $h^{-1}m^{-2}$) for years of operation

10 years of experience

Dübendorf, 2007



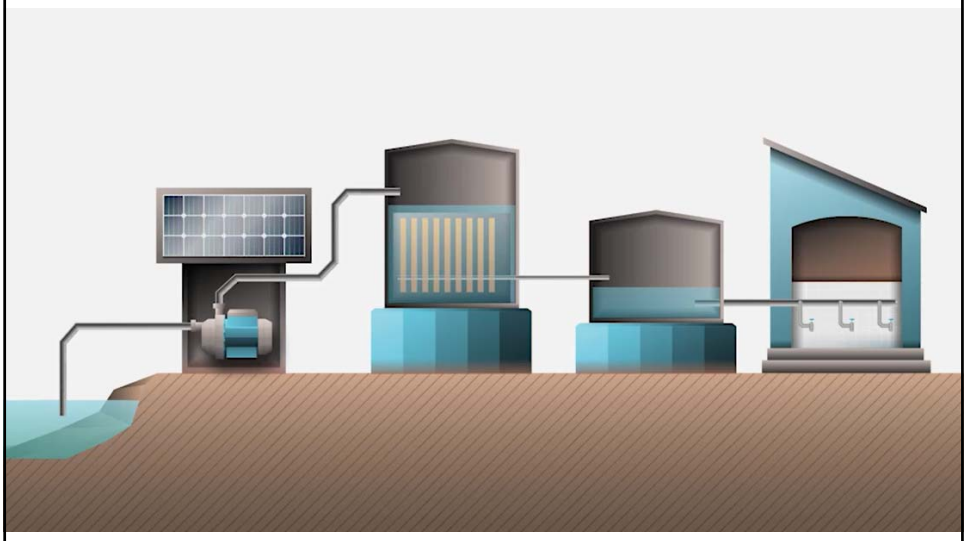
Kenya, 2010

Uganda, since 2015

Gravity driven membrane filtration

- Use of local resources
- Only import: Ultrafiltration flat sheet membrane modules; pore size of 20-40 nm; 75 m2
- no backflushing or chemical cleaning of membranes
- no external energy supply for treatment
- turbid raw water with high organic matter content
- 4000-6000 L/day

Gravit'eau: Water kiosks



Water kiosks for schools & community

Business Set-up

Kiosks provide water for free to schools; to households 1 USD/month

Managed & operated by school in collaboration with community committee

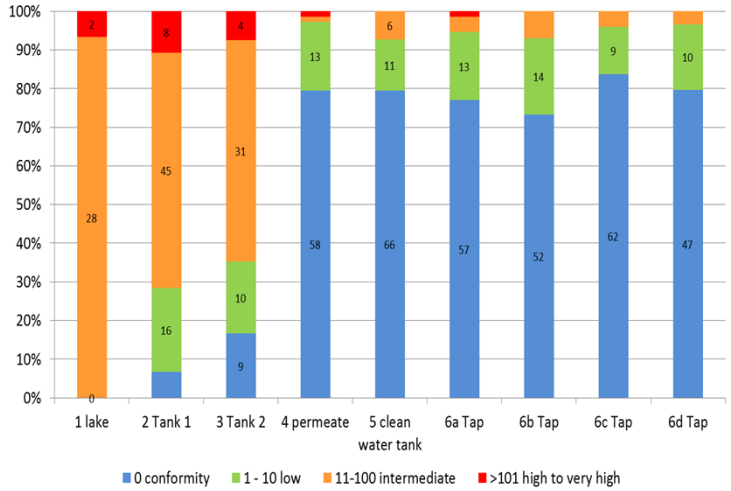
Income covers cost for regular O&M

Maintenance support & repair: local technical institute

Regular quality control

Microbial water quality: *E.coli* reduction

Number of samples in four *E.coli* count categories during 2015-2016



No E.coli detected after the starting phase during stable operation in permeate and taps

Results

Technical

- Stable flux. Flowrates 2-6 L/ m2h. On average, 6.5 hours of filtration to cover the demand
- Low requirements for O&M. Monthly: solar panels; flushing of tanks, regular pump control
- Chlorination of jerrycans to avoid recontamintion

Operational

- High demand for water from the kiosk
- Income is enhanced by sale of other health items at the kiosk
- Raw water consumption ↓ from 73%-41%
  Diarrhoea of children ↓ from 34% to 14%
- Scale-up required for sustainability

Possible Collaboration Eawag - Lions

Implementation of WASH innovations

- Eawag/ Sandec works with local partner NGO's to implemente and evaluate innovations.
- We also would like to enhance the uptake of promising research outputs.
- However, financial support is needed to promote and scale-up promising WASH innovations.

Advice to the Lions WaSH Working Group

- Eawag/ Sandec has a long working experience and a large network in the WASH sector.
- Through the exchange with the Lion's WaSH Working Group -> support the successful implementation of Lion's WASH activities.