Ecosan capacity building and awareness raising amongst water sector professionals

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Content of presentation

1. Overview of UNESCO-IHE
2. Capacity building needs in the area of ecosan
3. What does UNESCO-IHE do for capacity building in ecosan?
4. Ecosan at the workplace: Awareness raising at UNESCO-IHE
1. Overview of UNESCO-IHE Institute for Water Education
Brief history

1955 Bangladesh Ambassador to the Netherlands requests transfer of Dutch expertise in Hydraulic Engineering to Bangladesh

1957 IHE established as an International Education Institute

1991 IHE Delft becomes an independent Foundation

2003 UNESCO-IHE Institute for Water Education becomes operational

2007 Celebrating 50 year anniversary!
Staff and students
(current for 2005)

160 Staff (80 Academic, 80 Support)

4 Water and Environment Academic Programmes:
- About 220 MSc participants (from about 80 countries)
- 53 PhD participants
- 250 Short Course Participants
Vision:
UNESCO-IHE envisions a world in which people manage their water and environmental resources in a sustainable manner, and in which all sectors of society, particularly the poor, can enjoy the benefits of basic services.

Mission:
The mission of the Institute is to contribute to the education and training of professionals and to build the capacity of sector organisations, knowledge centres and other institutions active in the fields of water, the environment and infrastructure, in developing countries and countries in transition.
### Four Masters of Science Programmes

<table>
<thead>
<tr>
<th>Master Degree Programmes</th>
<th>Specializations</th>
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<tbody>
<tr>
<td><strong>Water Management</strong></td>
<td><em>Water Resources Management</em></td>
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<td><em>Water Services Management</em></td>
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<td><em>Water Quality Management</em></td>
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<td><strong>Environmental Science</strong></td>
<td><em>Environmental Science and Technology</em></td>
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<td><em>Environmental Planning and Management</em></td>
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<td><em>Limnology and Wetland Ecosystems</em></td>
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<td><em>Water Quality Management</em></td>
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<tr>
<td><strong>Municipal Water and Infrastructure</strong></td>
<td><em>Water Supply Engineering</em></td>
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<td><em>Sanitary Engineering</em></td>
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<td><em>Integrated Urban Management</em></td>
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<tr>
<td><strong>Water Science and Engineering</strong></td>
<td><em>Hydraulic Engineering - Coastal Engineering and Port Development</em></td>
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<td><em>Hydraulic Engineering - Land and Water Development</em></td>
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<td><em>Hydraulic Engineering and River Basin Development</em></td>
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<tr>
<td></td>
<td><em>Hydroinformatics</em></td>
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<td></td>
<td><em>Hydrology and Water Resources</em></td>
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</tbody>
</table>
Online courses

- Ecological Sanitation (ecosan)
- Wetland Management
- Wetlands for Water Quality
- Integrated River Basin Management
- Public and Private Partnerships (PPP) in the water sector
- Flood Modelling for Management
- Water Transport & Distribution
- Water & Environmental Law and Policy
- Integrated Coastal Zone Management
- Cleaner Production & the Water Cycle

4-month courses, running twice per year (in part-time mode)

Check www.unesco-ihe.org for the most updated information
UNESCO-IHE alumni
(Virtual Alumni Community) – 13,000 people
2. Capacity building needs in the area of ecosan
What is “capacity building”?

- Capacity Building is much more than just training and includes the following:
  - Human resource development, the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively
  - Organizational development, the elaboration of management structures, processes and procedures
  - Institutional and legal framework development to enable organizations, institutions and agencies to enhance their capacities (citation: Urban Capacity Building Network)

Source: www.wikipedia.org
Capacity building needs for ecosan

Individuals, organisations and institutions need to obtain:

Understanding, knowledge, skills, access to information and training

with respect to:

social, technical, institutional, public health, environmental, economical aspects of ecosan
Ecosan is an inter-disciplinary field.

Civil/sanitary engineering

Logistics

Social sciences

Financing, management, business

Political sphere, communication

Ecological sanitation

Integrated Water Resources Management

Agriculture, soil fertility

Public health, hygiene education

The capacity of people and institutions in many different disciplines needs to be built!
We use the “Active learning” approach in our teaching and training – What counts as active learning?

- Learners need to be:
  - engaged in goal-oriented tasks
  - practising skills
  - exploring and experimenting
  - using feedback to adapt actions
  - discussing what they do
  - reflecting on experience
  - articulating their ideas

- Related pedagogic concepts:
  - Inquiry-based education
  - Constructivism
  - Mediated learning
  - Discovery learning
  - Learning as conversation
  - Problem-based learning
  - Reflective practice
  - Meta-cognition
  - Experiential learning
  - Learner-oriented approach
  - Social constructivism
  - Situated learning

Source: Diana Laurillard at keynote lecture at UNESCO-IHE, March 2007
Why is E-learning* becoming attractive?

- It offers many opportunities for learners to:
  - be engaged in goal-oriented tasks
  - practice skills
  - explore and experiment
  - use feedback to adapt actions
  - discuss what they do
  - reflect on experience
  - articulate their ideas

* E-learning: Information technology assisted teaching and learning, e.g. online courses, e-conferences, video conferencing, etc.
New media and delivery technologies for information processing and communications - recent history

1970s  Interactive computers - new medium for articulating ideas
      | Local drives & discs - local storage with the user
1980s  WIMP interfaces - devices for ease of access to content
      | Internet - mass production / distribution of content
      | Multimedia - elaborated forms of content
1990s  Worldwide Web - wide access to extensive content
      | Laptops - personal portable access to the medium
      | Email - mass delivery of messages
      | Search engines - easier access to extensive content
      | Broadband - rich content / immediate communication
2000s  3G mobiles - low-cost access to elaborate content
      | Blogs - personal mass publishing
3. What does UNESCO-IHE do for capacity building in ecosan?
Activities at UNESCO-IHE for capacity building in ecosan

- **Online course on ecosan** (running for the first time March to June 2007, 24 participants) – will run twice per year in the future
  - Target audience: water and health sector professionals (at MSc level)
- **Short course on Decentralised Water Supply and Sanitation** (each year in July/August, 3 weeks; includes ecosan content)
- **MSc thesis topics on ecosan** (2-3 per year; students from Sanitary Engineering specialisation)
- **PhD thesis topics**
## Module: ES01 - Ecological Sanitation

### Announcement

<table>
<thead>
<tr>
<th>Topic</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have made a voice recording about the Advanced Sanitation Conference</td>
<td>2007/3/14</td>
<td>2007/4/30</td>
</tr>
<tr>
<td>Conference Proceedings now available on this site</td>
<td>2007/3/16</td>
<td>2007/4/15</td>
</tr>
<tr>
<td>Here is some interesting info about your classmates</td>
<td>2007/3/18</td>
<td>2007/4/30</td>
</tr>
<tr>
<td>Some interim results from questionnaire on Course 1 Unit 2</td>
<td>2007/3/21</td>
<td>2007/4/20</td>
</tr>
<tr>
<td>You should currently still be working on Course 1 Unit 3 (until Wednesday NEXT week)</td>
<td>2007/3/21</td>
<td>2007/4/20</td>
</tr>
<tr>
<td>Detlefs photos from India</td>
<td>2007/3/22</td>
<td>2007/4/21</td>
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<tr>
<td>Tomorrow is the start of Course 2 Unit 1</td>
<td>2007/3/26</td>
<td>2007/4/27</td>
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### Module Questionnaire

<table>
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<tr>
<th>Topic</th>
<th>Start Date</th>
<th>End Date</th>
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</thead>
<tbody>
<tr>
<td>Quick survey about use of e-mails, assignment, discussion (general state of affairs)...</td>
<td>2007/3/8</td>
<td>2007/4/10</td>
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<tr>
<td>Evaluation of Course 1 Unit 2: please fill in when you are pretty much finished with unit 2</td>
<td>2007/3/15</td>
<td>2007/4/15</td>
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<tr>
<td>Evaluation of Course 1 Unit 3: please fill in when you have completed this unit</td>
<td>2007/3/27</td>
<td>2007/4/27</td>
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</table>
Course: Transfer and treatment of human excreta and greywater

Course Content

- Unit 1: Treatment aspects for urine, faeces and greywater
- Unit 2: Conventional on-site sanitation
- Unit 3: Storage and transport logistics
- Unit 4: Introduction to anaerobic treatment technologies
- Unit 5: Introduction to constructed wetlands
- Unit 6: Introduction to composting
- Unit 7: Conventional faecal sludge management
- Unit 8: Small-bore sewer systems
- Unit 9: Urban groundwater pollution
- Unit 10: Course assignments (assignment number 1)
### Classmates

<table>
<thead>
<tr>
<th>Student ID</th>
<th>Student Name</th>
<th>Gender</th>
<th>E-mail</th>
<th>Picture</th>
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<tr>
<td>1234</td>
<td>User, Demo</td>
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<td>Agthoven</td>
<td>van Agthoven, Astrid</td>
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<td>Anwar</td>
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<td>Araujo</td>
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<td>Dusingizumuremi, Eugene</td>
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<td>Hara</td>
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## Discussion

Use your Browser controls to navigate through the discussion. For example, when using Microsoft Internet Explorer, use: CTRL-F "Topic" to jump to the next Topic, CTRL-End to jump to the end of the page, or CTRL-Home to jump to the top of the page.

- **Small task 5: Select a suitable toilet type**
  - Author: Module Coordinator: Muench, Elisabeth von
  - Views: 78
  - Replies: 13
  - Post Date: 2007/3/23
  - Reply Date: 2007/3/31

- **Small task 4: Estimate your own greywater production**
  - Author: Module Coordinator: Muench, Elisabeth von
  - Views: 184
  - Replies: 33
  - Post Date: 2007/3/9
  - Reply Date: 2007/3/31

- **Small task 3: Your own experience with slums**
  - Author: Module Coordinator: Muench, Elisabeth von
  - Views: 170
  - Replies: 29
  - Post Date: 2007/2/29
  - Reply Date: 2007/3/31

- **This is the place to put information about what else is going on in your life right now**
  - Author: Module Coordinator: Muench, Elisabeth von
  - Views: 260
  - Replies: 52
  - Post Date: 2007/3/2
  - Reply Date: 2007/3/30

- **Merits and demerits of online education/training**
  - Author: Module Coordinator: Muench, Elisabeth
  - Views: 68
  - Replies: 11
  - Post Date: 2007/3/20
  - Reply Date: 2007/3/29
Reply by Student : Hanan Kasenga  Post Date : 3/28/2007

Well for my project I would install the dry UD toilets, the sitting type. The reason is simple, I have never seen nor used a functional one yet am I want to see if it doesn't produce smell. The other reason is that a few months where am staying, they do experience water problems time and again. I think it would be ideal. And I would install one toilet per household.

The first time I saw a picture of a UD was in 2004 and I thought, yaa ...people are innovative. But of course I had worries why people should be forced to make sure urine goes here and faeces there.

Reply by Student : User, Demo  Post Date : 3/29/2007

Elisabeth here:
Kasanja, did you see the posting of your country mate Osweel Kotoka (he says he knows you) from Lusaka Water and Sewerage Corporation on the Ecosanres Discussion Forum a few days ago? He said that ecosan is now being implemented in Zambia (I can't remember now where in the country) - is this a project that you could go and visit? If you are not yet a member of that discussion forum, I can copy the posting for you to here, just let me know.

And how is that Mondialagro project of yours coming along?

Reply by Student : Heijnen, Marieke  Post Date : 3/29/2007

In the neighborhood that I live I would install UD vacuum toilets- I live in an apartment building, where each apartment has two floors and two toilets, so I would probably only be able to serve 25 apartments. I think UD would be too large a jump for most people in the Netherlands, and my apartment block is quite old. I think if a new apartment block was being built, and if I could do lots of awareness raising, people would be more willing to accept different types of technologies. But for now, UD vacuum toilets- they save lots of water and at the same time people don't have to change their behaviour much. They would all be ceramic pedestals, which would be most acceptable.
4. Ecosan at the workplace – awareness raising at UNESCO-IHE

*Practise what you preach!*
Two types of urine-diversion (UD) toilets

**UD waterless toilets**
- UDD or composting
- Not “forgiving” to misuse
- Requires shift in thinking for those that are used to waterborne sanitation
- May need separate compartment for anal washing
- We have it at UNESCO-IHE

**UD water flush toilets**
- Very similar to conventional water-flush toilets
- Very easy to use, “forgiving” to misuse
- Urine collected with or without water
- Faeces always collected with water
- Eawag researchers call this the “NoMix toilet”
- Installed at Eawag building (Switzerland) and GTZ building (Germany) and many other places
Roediger “NoMix toilet” in GTZ building in Eschborn, Germany; 56 toilets installed Aug 06 (photos taken Oct 06)

1-2 L for urine flush (or zero), 4-6 L for solids flush

Rod to activate valve for urine pipe when user sits
Toilet designs for “washers”
(“washers” use water for anal cleansing, e.g. most Muslims)

Drain or hole for anal washwater
(close to wall so that it is not used for urination)

SCOPE, India

CREPA, Burkina Faso
Vacuum toilets

- Usually without urine diversion (but can also be with UD)
- Very low amount of flush water needed
  - Typically uses only 1 L per flush (compared to 9 L per flush for conventional toilet)
  - Results in the production of concentrated "blackwater"
- This blackwater is usually treated with anaerobic digestion
The waterless sanitation in our building

- Hardware installed:
  - 11 waterless urinals (Uridan, Denmark) – for males, installed in April 2006
  - One UDD toilet* (Separett, Sweden) – for females, installed in May 2006
- I chose the UDD toilet over the UD water-flush toilet because of the simplicity of technology
- Main purpose is awareness raising for waterless sanitation options and ultimately ecosan
  - No storage and reuse of urine and faeces at this site (yet)

UDD = Urine-diversion dehydration
Estimated break-down of water consumption by type in our building

This is the amount of water that could be saved by switching to waterless urinals.

- Laboratory, boiler top-up and outside use: 30%
- Kitchen: 18%
- Urinal flushing: 15%
- Toilet flushing: 5%
- Hand washing: 2%
- Drinking tap water: 2%

This pie chart shows the distribution of water consumption by type.
Annual water consumption at UNESCO-IHE

Annual water consumption

Average for last 2 years:
4332 m$^3$

Prediction with a 15% water use reduction
Cost of water and wastewater for UNESCO-IHE

Drinking water (Eneco): 1.08 €/m³

Wastewater charges (Delflanden Waterboard): 1.38 €/m³ (that means per m³ of drinking water metered)

Total: 2.46 €/m³

these figures from Eneco do not include the wastewater charge!
Why have waterless* urinals for men?

- Reduces water consumption (conventional urinals use 4-6 L per flush)
- Enables collection of undiluted urine (for reuse as fertiliser) – not (yet) practised at UNESCO-IHE
- Does not pollute precious drinking water just for transport of urine
- Can be just as hygienic with same or less odour than conventional urinals

→ Mostly used at public places, not usually in private homes (lack of space)

→ The easiest „first step of ecosan“! (Reuse of sanitised urine as fertiliser would be the second step to close the loop)

* “waterless” means: no water
Suppliers of waterless urinals

- Main suppliers in Europe:
  - Ernst (1)
  - Keramag (2)
  - Uridan (3)

- Others:
  - Waterless
  - Falcon Waterfree USA
  - Sinaqua Waterless Deutschland
  - Bluebook Armitage Shanks / Ideal Standard UK
  - Sphinx Hellbrok Locus Waterless no-flush urinals
  - Water Matrix Waterless No-Flush Urinal
  - Porcher

Choose carefully - One good indicator is always their reference list and technical knowledge
Odour control methods for waterless urinals

- **Attention to urinal surface**
  - Special smooth surface material (e.g. wax coating) to reduce sticking of urine and bacterial biofilm
  - Wipe surface of urinal once, twice or several times per day with moist sponge

- **Block the odour from urine pipe, urine storage tank or sewer, e.g.:**
  - Seal with floating oil layer (e.g. Uridan)
  - Mechanical seal, e.g. membrane flexible tube (e.g. Keramag)
  - Old light bulb or other cheap designs are possible
Keramag waterless urinals

Patented membrane odour stop system (Keramag Centaurus)
Uridan urinals have a blocking fluid against odour from the sewer

Blocking fluid ("Uriloock"):  
- Plant-oil based (200 mL for one urinal)  
- Needs to be replaced once urine crystals or solids have accumulated  
- This occurs after about 7,000 uses of the urinal (according to supplier)  
- Cost of Uriloock: was € 18 per 200 mL, is now € 4 per 200 mL (February 2007)

Disadvantages:  
- Stagnant urine leads to urine precipitates and ultimately blockages  
- Cost for blocking fluids replacements
Waterless urinals in our building

Old urinal (about 4 L of flush water per use)  
New waterless urinal (0 L of flush water per use)
Our UDD toilet on display before installation (Separett “Villa” model)

Exhaust pipe, power plug for fan and urine discharge pipe

Vault/bin

Note blue flap to cover faeces bin when not in use for aesthetic purposes
Details of Separett “Villa” model

As the user sits down, the faeces compartment opens.

Open toilet: Bucket for faeces collection.

- Fan
- Urine drain pipe
One ladies toilet
(for wipers only, meaning not suitable for washers unless they wash over the urine compartment)

To building’s ventilation system

Squeeze bottle to rinse urine compartment (e.g. menstrual blood)
Toilet paper and faeces (the cleaning staff has to empty the bag to solid waste bin daily)

On most days the bin contains 90-100% toilet paper and 0-10% faeces (by volume)

Note: There are no odour problems because faeces are kept dry and separate from urine; a fan and vent extract any odours effectively

Urine pipe (to sewer)
Please clean up after yourself!

Give the urine compartment a little rinse with the squirt bottle (if it looks dirty)

Clean the side of the faeces compartment with the brush (if needed, make brush a bit moist by using the squirt bottle)
Operational challenges with UDD toilet* in IHE building

- Some staff members don’t like using this toilet, they have the feeling that it is not hygienic.
- Occasionally, too much urine was discharged to the faeces bin, and I have also seen water and detergent in the faeces bin.
- Twice in 10 months of operation, somebody defecated into the urine collection front part of the toilet, where the faeces got stuck.
- Some of the cleaning staff are refusing to carry out the daily task of faeces bin emptying.
- When the toilet gets dirty, some of the cleaning staff is reluctant to clean it properly.

* UDD = Urine-diversion dehydration
A majority of users is satisfied with the odour level
- waterless urinals for males; UDD toilet for females

Surveys carried out by MSc students: Survey 1 in July 2006, Survey 2 in Feb 2007
Usage patterns of waterless urinals (males) and UDD toilet (females)

Most of the male non-users don't use any public urinals due to the need for washing (Muslims).
Even if some females have used the UDD toilet only once, the objective of awareness raising has still been achieved.
Summary

1. A large demand for capacity building (education and training) in ecosan for many different disciplines and society sectors exists.

2. UNESCO-IHE is active in capacity building for ecosan, most notably with online ecosan course (at MSc level)
   - UNESCO-IHE is using Active Learning approaches which can be coupled with e-learning very effectively.

3. We practise what we preach and raise awareness: waterless sanitation in our building (waterless urinals and UDD toilet)
   - Waterless urinals are a well-established technology.
You don’t think any of this (ecosan / online learning) will happen?

- “This “telephone” has too many shortcomings to be seriously considered as a means of communication.” (Western Union memo 1876)

- “…there’s a world market for about 5 computers.” (Thomas Watson, Chairman IBM 1943)

- “Computers in the future may weigh no more than 1.5 tons.” (Popular Mechanics, 1949)

- “…data processing is a fad that won't last out the year.” (Editor of business books Prentice Hall, 1957)

- “There’s no reason for any individual to have a computer in their homes” (Ken Olson, Chairman, Digital Corp. 1977)

- “640K ought to be enough for anybody.” (Bill Gates, 1981)

Compiled by Prof Gilly Salmon, University of Leicester
Optional slides – only if anyone asks
- This is what it looks like when the blue blocking fluid needs replacement
- Urine would still drain through it, but slower than normal (building up some head)
- Eventually, the urine would no longer flow through
## Project capital cost

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<th>Item</th>
<th>Unit cost</th>
<th>Unit</th>
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<th>Cost</th>
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<tbody>
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<td>Uridan urinals (including delivery)</td>
<td>€ 695</td>
<td>number</td>
<td>11</td>
<td>€ 7,645</td>
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<tr>
<td>Separett UDD toilet (including delivery)</td>
<td>€ 650</td>
<td>number</td>
<td>1</td>
<td>€ 650</td>
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<tr>
<td>Installation of urinals (contract plumber)</td>
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<td>per urinal</td>
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<td>Total</td>
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Costs without BTW (= VAT) of 19%, since UNESCO-IHE gets that back at end of financial year
# Project operating costs

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<tr>
<td>Urinal and UDD toilet cleaning, time to replace blocking fluid</td>
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<td>€ -</td>
<td>No significant difference to before</td>
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<td>Lower drinking water consumption due to waterless urinals</td>
<td>€ 1.08</td>
<td>m³</td>
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<td>€ 702-</td>
<td>Assume 15% reduction compared to 2005/2006 average</td>
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<td>Lower wastewater charge</td>
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<tr>
<td>Cost of blocking fluid Urilock</td>
<td>€ 4.00</td>
<td>200 mL</td>
<td>132</td>
<td>€ 528</td>
<td>Replace in all urinals once per month</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>€ 1,071-</td>
<td>Note: net saving</td>
</tr>
</tbody>
</table>

Water savings from one UDD toilet negligible
Purpose of using the UDD toilet for females

Most females use UDD toilet to urinate only (36 female users, survey 2)

- Urinate only: 81%
- Urinate and defecate: 17%
- No answer: 3%
Reasons for not using facilities (several answers possible)
- waterless urinals for males; UDD toilet for females

Survey 1 females (total answers: 22)
- Religious (washers)
- Far from office
- Not hygienic or horrified by idea
- Bad odour
- Other or no answer

Survey 2 females (total answers: 23)
- Religious (washers)
- Far from office
- Not hygienic or horrified by idea
- Bad odour
- Other or no answer

Survey 2 males (total answers: 22)
- Religious (washers)
- Far from office
- Not hygienic or horrified by idea
- Bad odour
- Other or no answer