Introducing a novel household water treatment filter

Maryna Peter-Varbanets, Rick Johnston, Wouter Pronk
Regula Meierhofer, Selina Deeks, Michael Krohn

Households prefer filters ... "the E. coli reductions achieved by dilute hypochlorite and the flocculant-disinfectant are ... higher than the reductions achieved by filters. At the same time, households ranked filters most frequently as their most preferred product" - Albert, J et al., 2010, End-user preferences for and performance of competing POU water treatment technologies among the rural poor of Kenya. ES&T, Vol. 44, p. 4426.

"Without considering the cost of purchase or use, the most popular method across all districts was the CS (ceramic) filter for its ease of use, followed by chlorinating water" - USAID, 2007, Bringing the consumer to the table: perceptions and practice of household water treatment methods in Nepal. USAID: Washington.

"... filters were preferred to combination products and chemical additives" - Poulos, C. et al., 2012 Consumer preferences for household water treatment products in Andhra Pradesh, India. Journal of Social Science and Medicine, in press.

Filters on the market

**Ceramic filters**
- Ceramic pots
- Candle filters

- Advantages Disadvantages
  - Simple operation, local production
  - Turbidity is removed
  - Good reduction of bacteria
  - No change in taste and odor of water
  - Fragility: frequent filter breakages
  - Low effectiveness against viruses
  - Regular cleaning required
  - Clogs with turbid waters

**Membrane filters**
- Lifestraw family

- Advantages Disadvantages
  - Removes also viruses
  - One step treatment
  - Compact
  - Complex handling, backwashing
  - High risk of recontamination
  - Taps can be mixed

**Multistage filters**
- Filtration and contact disinfection: (Purelt, Aquasure, Tata Swach)
- Ceramic filtration and adsorption (Ensign, Seefar)
- Complex RO or UV systems (Purelt Marvello, Aquaguard, Emerald)

- Advantages Disadvantages
  - Attractive design
  - Simple and easy to use
  - High flow rates
  - Removal of protozoa, bacteria and viruses
  - Regular replacement of cartridges
  - Risk of clogging with turbid waters
  - Limited capacity
  - High capital and operational costs

**Ultrafiltration**
- Particles, Viruses
- Bacteria

Operation of ultrafiltration on any scale requires:
- Regular backflushing
- Disinfection
- Chemical cleaning
- Pre-treatment
- Pressure of 1-10 m water column

**Gravity-Driven Membrane (GDM) filtration**
- Very low pressure
- No backflushing
- No chemical cleaning
- Long-term operation


24 L/day with only 0.5 m²
No clogging due to open biofilm structure

- Macro and microorganisms shape the biofilm
- Membranes do not need cleaning
- Better removal of viruses

Advantages of GDM-filtration

- Effective: Parasites, Viruses, Bacteria
- Easy: no energy, almost no maintenance
- Robust: even highly turbid water can be used, not fragile
- Long life span: expected life span 5-8 years → therefore, low costs for the expected life span
- No recurring costs (e.g. chemicals)

GDM project

- Goal: development, design, production and sustainable implementation of a novel GDM household water filter

GDM - filter: Lab scale → Large scale production

Distribution: Field study → Functioning distribution network

Financing: → Long-term financial sustainability

Field evaluation in Kajiado and Thika, Kenya (May 2011 – June 2012)

<table>
<thead>
<tr>
<th>Water type</th>
<th>Turbidity</th>
<th>TOC, mg/L</th>
<th>E. Coli in 100 ml</th>
<th>E. Coli in 100 ml</th>
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<td>Pond</td>
<td>300</td>
<td>10.2</td>
<td>1500</td>
<td>1500</td>
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<tr>
<td>Borehole</td>
<td>&lt; 1</td>
<td>2.3</td>
<td>154</td>
<td></td>
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<tr>
<td>Protected Shallow well</td>
<td>35</td>
<td>13.4</td>
<td>57</td>
<td></td>
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<tr>
<td>Open well</td>
<td>&lt;5</td>
<td>9.1</td>
<td>587</td>
<td></td>
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<tr>
<td>River, Thika</td>
<td>22</td>
<td>4.6</td>
<td>425</td>
<td></td>
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<tr>
<td>Tap water, Nairobi</td>
<td>&lt;1</td>
<td>n.d.</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Consumption habits after 8-10 months

Frequency of use of 24 GDM filters prototypes during Dec. 2011 - March 2012 measured by level loggers

- > 3 times per week: 34%
- 1-3 times per week: 21%
- < 1 time per week: 29%
- Not in use: 8%
- Not monitored: 8%
Flow rate and water flux

Thika river water -
Flux of 2-4 L per hour and m²

Flux at 20cm
Flux at 15cm

Thika river water - «worst case» water quality:
Flux of 1-2 L per hour and m²

Filter THR24: use and performance in Monitoring Period 7

Filter KJP07: use and performance in Monitoring Period 7/

Summary: field evaluation

After 1 year:
• 22 filters are in use
• Good pathogen removal
• Sufficient flow rates in spite of thick biofilm
• Still high interest from communities

• Recontamination and re-growth
• Cleaning of sludge

⇒ Design improvements

GDM-filter design evolution

Research
Bench-scale
Technical evaluation in field
Design study
User Interface

Membrane module development

Household scale modules are not available commercially

Requirements:
• Simple and low-cost production at scale
• Quality control
• European drinking water standards for materials
• Goal: 15 CHF at scale (membrane costs 6-8 CHF)
• Reliable industrial partner

Evaluating design

V.1 – all in one V.2 – in 3 parts V.3 – inversed

• Technical parameters (oxygen, drying, biofilm accumulation, flow rate, etc.)
• User interface (risk of re-contamination, ease of cleaning, stability, etc.)
Next steps

- Field study with 20-50 new generation prototypes in Kenya and Uganda in Autumn 2012:
  - User feedback on the new design. Further optimization needs
  - Technical evaluation of the optimized membrane module in the field
  - Detailed study on the re-growth and recontamination problems

Goals for 2013:

- Production of tools, contracting
- Distribution of 3000-5000 systems within a carbon credit project in Uganda and Kenya
- Scale up of production

Collaborations:

**Design partners:**
Zurich University of Arts

**Kenya:**
Kenya Water for Health Organization (KWAHO)

**Industrial partners:**
Microdyn-Nadir, MMF, Weise Water Systems

**Internal Eawag collaborations:**
Environmental Engineering and Microbiology departments

**Financial support**
Swiss Agency for Development and Cooperation SDC
Dr. F.C. Flick
Eawag
Carbon Credits for HWTS Projects: An Introduction

Roman Schibli, Senior Project Manager, South Pole Carbon

Contents

- Background on the Carbon Markets
  - HWTS and the Carbon Markets
  - South Pole’s International Water PoA
  - A bit about South Pole

Our challenge – climate change

The principle behind carbon trading

Every carbon reduction project has to go through a lengthy approval process

We distinguish compliance and voluntary carbon markets

- EU Emission Trading Scheme
  - Kyoto Protocol Market
  - Australian Emission Trading Scheme

- Gold Standard VERs
  - VCUs
  - CCBS
  - Social Carbon
  
Examples

Key features

- Different types of compliance carbon credits
  - Kyoto credits (CDM and JI) can be sold to Kyoto and EU markets
  - High liquidity
  - Unit price varies little across projects (~4 EUR), but premium for Gold Standard certified projects
  - Turnover 2010: 140 billion USD

- Gold Standard projects fetching the highest price (~8 – 15 EUR per tCO2e)
  - Turnover 2010: 130 million USD

- Carbon credits generated on the basis of voluntary standards
  - Not suitable for compliance purposes (Kyoto)
  - Prices vary with quality and origin of projects
  - Turnover 2010: 130 million USD

- Compliance markets
  - Voluntary markets

Total cost until first issuance of carbon credits: 100k – 150k EUR

Total cost until first issuance of carbon credits: ~200k EUR

But: next projects ~50k EUR

Source: UK Gov and Met Office
Typical project types that qualify for carbon credits

**Renewable Energies**
- Hydropower
- Geothermal energy
- Wind power
- Solar power
- Biomass

**Forestry**
- Afforestation
- Reforestation

**Household**
- Water purification
- Efficient cooking stoves
- Efficient light bulbs
- Methane capture from landfills and conversion to electricity
- Anaerobic digestion of wastewater, coupled with electricity generation
- Methane capture from mines and conversion to electricity
- Cogeneration with Biomass and Biofuels
- Waste Heat Recovery
- Energy efficiency

**Industrial Processes**
- Renewable Energies

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Water Purification Projects can generate carbon revenues by...

... reducing the use and demand for fossil fuels and non-renewable biomass that would have been used to boil water as a mean for water purification and thus directly leading to the reduction of greenhouse gas emissions

Boiling water

Possible solutions

- Solar disinfection
- Membrane
- Chemical disinfection

Boiling water

Project Scenario

Carbon credits

GHG Emissions pre-project
GHG emissions project
Emmission reductions

3 methodologies exist for HWTS projects to generate carbon credits

**AMS-III.AV (Version 2.0)**
- Small scale compliance methodology
- Limit: 60,000 tCO2e per year
- Very standardized approach
- Possible to use in Pokh
- 3 PoAs currently under development
- [http://cdm.unfccc.int/methodologies/DB/DUFHO6ZC1Z9IE3THBDUNRNTV0BC0/view.html](http://cdm.unfccc.int/methodologies/DB/DUFHO6ZC1Z9IE3THBDUNRNTV0BC0/view.html)

**AMS-66 (Version 1.1)**
- Large scale Gold Standard voluntary methodology
- No size limit for each project
- Developed by Hindustan Unilever
- Very specific applicability => so far no project using it
- [http://cdm.unfccc.int/methodologies/DB/9VTXPHAU3QSG26CDIU0EWX81JSYKKO/view.html](http://cdm.unfccc.int/methodologies/DB/9VTXPHAU3QSG26CDIU0EWX81JSYKKO/view.html)

**AM0086**
- Large scale Gold Standard voluntary methodology
- Not possible to use for compliance credits
- No size limit for each project
- 3 PoAs currently under development
- [http://cdm.unfccc.int/methodologies/DB/9VTXPHAU3QSG26CDIU0EWX81JSYKKO/view.html](http://cdm.unfccc.int/methodologies/DB/9VTXPHAU3QSG26CDIU0EWX81JSYKKO/view.html)

Characteristics of AMS-III.AV

- Wide range of possible technologies
  - water filters (e.g. membrane, activated carbon, ceramic filters)
  - solar energy powered UV (ultraviolet) disinfection devices
  - photocatalytic disinfection equipment
  - pasteurization appliances

- Very stringent requirements: WHO protective standard
  - 2 log Bacteria, 3 log viruses, 2 log Protozoa (C. jejuni, Cryptosporidium, Rotavirus)

- Eligible areas
  - Only if no public distribution network of safe drinking water exists
  - Case 1: At least 40% don’t have access to improved drinking water
  - Case 2: other situations

- The monitoring requirements of AMS-III.AV are relatively streamlined

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>How</th>
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<tbody>
<tr>
<td>Water distrib. Network?</td>
<td>Annually</td>
<td>Check</td>
</tr>
<tr>
<td>Amount water per person</td>
<td>Once initially</td>
<td>Surveys (Case 2), literature value or expert opinion (Case 1)</td>
</tr>
<tr>
<td>nRB</td>
<td>Once initially</td>
<td>Baseline study; or Default value (some LDCs)</td>
</tr>
<tr>
<td>type of stoves</td>
<td>Once initially</td>
<td>Baseline study; Efficiencies of stoves: default values</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Continuously</td>
<td>Samples</td>
</tr>
<tr>
<td>Functional Appliances &amp; # users/device</td>
<td>Yearly or bi-annually</td>
<td>Surveys</td>
</tr>
<tr>
<td>% of people boiling water</td>
<td>Once initially</td>
<td>Survey, Only Case 2</td>
</tr>
</tbody>
</table>
Contents

- Background on the Carbon Markets
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- A bit about South Pole

The International Water Purification Programme (IWPP) brings carbon revenues to water purification projects

Water purification projects in various countries using various technologies can earn carbon credits

Pure Water Ltd. will be working closely with project implementers and financiers of HWTS projects

Role & responsibilities

Pure Water Ltd. (South Pole subsidiary)

Project implementer

- Managing the International Water Purification Programme
- Ensure compliance with carbon market rules
- Optimize carbon strategy

Project implementer

- Implement household water purification projects (HWTS) on the ground
- Collect monitoring data and ensure proper project execution

Financier

- Provide upfront financing to scale HWTS projects
- Receive carbon credits for upfront financing
- Trade carbon credits in voluntary and/or compliance markets

Carbon revenues allow for a new business model for HWTS projects

Example business model for HWTS project

Use & monitoring of filters

Issuance of carbon credits

Subsidy & distribution

Sale of carbon credits

Upfront Payments, eg. 15 EUR per device*

Investment vehicle

Carbon revenues, eg. 21 EUR per device over 3 years**

*Assumption: 7.5 EUR subsidy per device, 7 EUR awareness campaign
*Assumption: 7 EUR per ton of carbon, 1 ton CO2e per device per year

South Pole – developing solutions worldwide

- Head office
- Satellite office
- Local presence

- 2006: Incorporation in Zurich / Switzerland
- 2011: ten offices worldwide
- 2011: Best Project Developer*
- Over 80 carbon professionals from 22 countries
- Specialized in high-quality “Gold Standard”
- Developing both voluntary and compliance credits

*Environmental Finance: Voluntary Carbon Market Survey 2011
Thank you

Contact
Roman Schibli
Senior Project Manager, Zurich
r.schibli@southpolecarbon.com

Bruce Wylie
Principal, South Africa
b.wylie@southpolecarbon.com

Ronnie Twesigye
PoA Specialist, Uganda
r.twesigye@southpolecarbon.com

www.southpolecarbon.com/adv-poa.htm
Carbon credits for water disinfection:

Models for promoting GDM Filters in Uganda

6. June 2012

Regula Meierhofer
Eawag: Swiss Federal Institute of Aquatic Science and Technology

Promoting Household Water Treatment at BoP

Lessons learnt from previous efforts to promote HWTS

1) ➔ People have to be convinced to treat their water
   (even if people know about risk they don’t act)

2) ➔ Habits have to be strengthened

3) ➔ The availability of HWTS products is critical for the sustainable application
Promoting Household Water Treatment at BoP

Characterizing customers at BoP:
- Low income 1-5 USD per day,
- Little access to credit,
- Difficult to reach through conventional distribution channels
- Demand for household water treatment has to be created

1) Create Demand
   through a community education
2) Establish product supply chain
   through innovative distribution and marketing models
3) Offer a realistic price
   - Evaluate willingness to pay
   - Microcredit, payment in installments
   - Subsidy

Behaviour change intervention strategy

Sustainable application of HWTS requires a comprehensive behaviour change intervention.

- Provide knowledge
  (Risk awareness and knowledge about solutions)
- Convince & Motivate (rational & emotional)
- Influence external factors (f.e. product availability)
- Strengthen habits
  - remind people & gain self-commitment
  - influence social norms & social influence
Evaluation of promotion & marketing models

- NGO Promoters
- Community Groups
- Health Workers
- Health Centers
- Distribution through wholesale
- Sale through NGO
- Sale through local entrepreneur
- Sale through CBO
- Sale through local entrepreneur

Product Pricing

Upfront investment cost will be a deciding factor for marketing water filters to BoP. The use of a subsidy might be needed to make product marketing feasible.

- Estimated production cost: 40-50 CHF
- Estimated distribution cost: 12-27 CHF
- Difficulty of BoP customers to make high upfront investments
  - Willingness to pay: 10-30 CHF

Evaluate
- Willingness to pay
- Different payment schemes
  - installments over a period
  - microcredit/“merry go round”?
- Subsidy (Carbon Credits)
Willingness to pay in Kenya

<table>
<thead>
<tr>
<th>Deciles</th>
<th>Percapita annual income (dollars)</th>
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<tr>
<td></td>
<td>Rural</td>
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<tr>
<td>10</td>
<td>126</td>
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<td>20</td>
<td>180</td>
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<td>30</td>
<td>239</td>
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<td>40</td>
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<td>50</td>
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<td>70</td>
<td>526</td>
</tr>
<tr>
<td>80</td>
<td>780</td>
</tr>
<tr>
<td>90</td>
<td>1,033</td>
</tr>
<tr>
<td>100</td>
<td>7,463</td>
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</table>

Source: Fumbi, Johnston & Brower: Study on Willingness to pay for GDM-Filters in Kenya. Not yet published

Implementation Model: income sources

**Community education:**
- Cost: ~20 CHF per household trained

Financed through:
- Development Organisations
- Foundations
- Social philanthropists
- Revenue through Carbon Credits

**GDM production and distribution:**
- Cost: 52-77 CHF per filter

Income generated through:
- Sale of filters: 10-30 CHF per filter
- Subsidy: 22-67 CHF per filter

financed through sale of Carbon Credits
Carbon Finance for Water Disinfection Projects

- In collaboration with South Pole developed a framework to use Carbon Credits for Water Disinfection. Contract signed in January 2012.
- Revenue from carbon certificates could be used to finance subsidy & a part of community education
- Developed a PoA under the Methodology: AMS III.AV./Version 02

- Required efficiency of technology:
  removal of 2 log Bacteria, 3 log viruses, 2 log Protozoa (C. jejuni, Cryptosporidium, Rotavirus)
- Areas without public distribution network of safe drinking water (annual check necessary)
- Case 1: Rural or urban areas with at least 40% of people not having access to an improved drinking water source ➔ suppressed demand recognized
- Case 2: Areas other than Case 1 (amount of people boiling has to be defined at baseline)

Monitoring requirements

For Case 1
- Biannual checking of all appliances to evaluate if they still are operating (or representative sample)
- Quantity of purified water per year (continuous basis or manufacturer’s specification of equipment)
- Annual check if distribution network is installed
- Water Quality monitoring on sample basis
- Total fuel and electricity consumption per year (calculated)
- Average volume of drinking water per person per day (cap 5.5 liters)

For Case 2 (additional)
- Ex-ante proportion of people boiling
Assessing baseline emissions in Uganda

Baseline emission reduction per filter per year

<table>
<thead>
<tr>
<th>BE</th>
<th>BE = QPW<em>SEC</em>f_NRB<em>EF</em>10^-9</th>
<th>1.97 tCO2/y</th>
<th>Calculated</th>
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<tbody>
<tr>
<td>QPW</td>
<td>Quantity of purified water per year</td>
<td>4l per person/day (*5)</td>
<td>Calculated</td>
</tr>
<tr>
<td>SEC</td>
<td>Specific energy consumption to boil 1l of water (depends on climate and efficiency of water boiling system replaced)</td>
<td>3347.19 kJ/L</td>
<td>Field survey (BL): -type of oven (3 stone fire) -type of energy (mostly wood)</td>
</tr>
<tr>
<td>fNRB</td>
<td>Fraction of woody biomass used in absence of project activity that can be established as non renewable</td>
<td>99%</td>
<td>High deforestation in Uganda (data FAO &amp; IPCC)</td>
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<tr>
<td>EF</td>
<td>Emission factor</td>
<td>81.6 tCO2/TJ</td>
<td>Default value (AMS-I.E)</td>
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Calculation of Carbon Revenue Models

Assumptions

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<tr>
<th>Assumption</th>
<th>Value</th>
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<tr>
<td>Crediting period</td>
<td>10 years</td>
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<tr>
<td>Emission Reduction</td>
<td>1.97 tCO2 per filter/ y</td>
</tr>
<tr>
<td>Price per CER</td>
<td>10 €</td>
</tr>
<tr>
<td>Application</td>
<td>5% loss of users/ y</td>
</tr>
<tr>
<td>Subsidy for filter</td>
<td>50 €</td>
</tr>
<tr>
<td>Training cost</td>
<td>20 €/ HH</td>
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<tr>
<td>Yearly monitoring cost</td>
<td>3 €/ HH</td>
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<td>Fixed monitoring cost</td>
<td>15'000 €/y</td>
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<tr>
<td>Carbon management cost</td>
<td>30'000 €</td>
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<tr>
<td>Carbon management cost</td>
<td>14'000 €</td>
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<tr>
<td>Carbon revenue sharing</td>
<td>variable</td>
</tr>
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</table>
### Calculation of Carbon Revenue Models

#### Model 1: Distribution of 3000 Filters over 5 years, 15'000 Filters
- Implementation & Monitoring Cost: 1'456'350 €
- Carbon Management Cost: 315'881 € (IRR: 6%)
- Revenue (carbon cost deducted): 1'666'888 € (NBW: 90'583 €)

#### Model 2: Distribution of 5000 Filters over 4 years, 20'000 Filters
- Implementation & Monitoring Cost: 1'912'777 €
- Carbon Management Cost: 373'641 € (IRR: 10%)
- Revenue (carbon cost deducted): 2'408'073 € (NBW: 297'614 €)

#### Model 3: Distribution of 10'000 Filters over 2 years, 20'000 Filters
- Implementation & Monitoring Cost: 1'952'608 €
- Carbon Management Cost: 388'654 € (IRR: 13%)
- Revenue (carbon cost deducted): 2'655'137 € (NBW: 467'519 €)

### Calculation of Carbon Revenue Models (CER 3.5 €)

#### Model 1: Distribution of 3000 Filters over 5 years, 15'000 Filters
- Implementation & Monitoring Cost (incl. Filter subsidy: 750'000 €): 1'456'350 €
- Carbon Management Cost: 202'849 € (IRR: -)
- Revenue (carbon cost deducted): 491'120 € (NBW: -893'595 €)

#### Model 2: Distribution of 5000 Filters over 4 years, 20'000 Filters
- Implementation & Monitoring Cost (incl. Filter subsidy: 1'000'000 €): 1'912'777 €
- Carbon Management Cost: 224'156 € (IRR: -)
- Revenue (carbon cost deducted): 749'444 € (NBW: -1'100'909 €)

#### Model 3: Distribution of 10'000 Filters over 2 years, 20'000 Filters
- Implementation & Monitoring Cost (incl. Filter subsidy: 1'000'000 €): 1'952'608 €
- Carbon Management Cost: 229'995 € (IRR: -)
- Revenue (carbon cost deducted): 835'332 € (NBW: -1'091'760 €)
Critical factors for a high revenue from Carbon Credits

- Implementation of large scale project necessary to justify high cost for project validation, registration & verification
- Sustainability of application...

Baseline Emissions:
- Type of stoves (efficiency) and fuel (percentage of charcoal, wood, kerosene, coal, biomass, electricity etc.) used in project area
- Energy consumption to boil water
- Local deforestation rate

- Volume of water treated/ consumed (ev. definition in method)
- Price per ton CO2
  - Currently at 3.5 Euro per CER at the compliance market
  - Much higher prices can be reached through the voluntary market
WASHTech

Technology Assessment Framework (TAF)

André Olschewski
Skat Foundation

AGUASAN, 113th Meeting, 6th June 2012, Bern
Content of presentation

- WASHTech
- Need for a Technology Assessment Framework (TAF)
- Conceptual structure of the TAF
- Four steps of the TAF
- Outlook and potential
WASHTech

- Action Research Project
- EU / FP7 funded
- Objective: to strengthen sector capacity to make effective investment in WASH technologies
- Countries: Burkina Faso, Ghana, Uganda
- Partners: IRC (Lead); Cranfield Univ., WSA (ex CREPA), KNUST, TRENDS, NETWAS, WaterAid UK, WaterAid Ghana / Burkina Faso / Ghana, Skat
### WASHTech: Key activities

<table>
<thead>
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<th>Activity</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tr>
<td>Literature Review</td>
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<tr>
<td>KAP Studies/MSC</td>
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<td></td>
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<tr>
<td>TAF Development</td>
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<tr>
<td>Capacity Building/Learning Alliances</td>
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<tr>
<td>TAF Testing in three rounds</td>
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<tr>
<td>TAF revision</td>
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<tr>
<td>Embedding</td>
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<td>Capacity Building/Learning Alliances</td>
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<td>TAF IT</td>
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<td>Sector Recommendation</td>
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<td>Guidance on Technology Introduction</td>
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<tr>
<td>Embedding</td>
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</tbody>
</table>

Annexes: 113 Aguasan Meeting June 2012
Successful and less successful introduction

Uptake [number of units installed]

High
Rope Pump Nicaragua
Promising Technology

Rope Pump Africa
Successful Technology

Little

20 years ago
Questionable

Play Pump

Time
Today

Annexes: 113 Aguasan Meeting June 2012
Successful technology introduction ....

- ...is not only about a “clever” technology but also about the “clever” and context specifically designed process for the introduction.

- So far there is no methodology in the research nor practice which links assessment with introduction process.

= Efficient allocation of funds for technology introduction needs a systematic and robust procedure for technology assessment → TAF.
Who are key actors in introduction of technologies?

- **Government (national, district) or development partners**, as regulators, supervisors, investors of introduction processes
- **Private sector**, as producer or provider
- **NGO**, e.g. develops a product or facilitates introduction process
- **Users, Buyers**
- **Research and Development**, develop or monitor introduction
- **Political Leaders**, other institutions as facilitators and promoters
Choice of investment model (e.g. Market based approach) influences roles of actors in the introduction process.
Six dimensions of sustainability

- Economic and Financial
- Social
- Environmental
- Institutional & Legal
- Skills & Knowhow
- Technological
TAF Key elements for technology introduction

Technology/Product
- Characteristics/Performance
- Requirements
- Development process

Introduction Process
- Time, timing
- Investment model
- Responsibilities of actors in the introduction process
- Resources

Context / Enabling Environment
- Physical
- Social
- Economic
- Legal
- Institutional
- Skills and capacities

Roles of key actors:
User, Buyer
Producer, Provider
Regulator, facilitator

Annexes: 113 Aguasan Meeting June 2012
Concept of the TAF Assessment

Perspectives of Key Actors in Introduction Process

- User or Buyer
- Producer or Provider
- Regulator, Investor, Facilitator

Sustainability Dimensions
- Economic
- Social
- Environmental
- Organisational, institutional, legal
- Skills & Knowhow
- Technological

TAF puts focus on key actors perspectives in the assessment AND considers key aspects for the introduction process.
TAF is a field visit / workshop based method → TAF forces user to perceive and consider perspectives of all key actors.

Annexes: 113 Aguasan Meeting June 2012
The TAF process starts with a screening. The screening focuses on two key questions:

» Is there a **need** for this technology?
» Is the **implementation** of this technology **feasible** in this region at all?

If the screening is positive, the technology is comprehensively assessed in step 2.

In step 3 the results are collected and presented.

In step 4 all results are comprehensively interpreted.
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- Holistic and transparent
- Includes key aspects of the introduction process
- Allows multiple entry points for interpretation
- Gives information for mitigation measures
- Provides basis for comparison of WASH technologies and selection
**TAF: Summary**

- TAF is a **decision making tool** on the applicability and sustainability of the use of a **specific** WASH technology in a **specific context** - considering critical linkages with the technology introduction process.

- To be used for various **WASH Technologies** - existing and new.

- Comprehensive assessment, based on field data, verification and scoring in workshops which involve **all** key actors.

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Annexes: 113 Aguasan Meeting June 2012
TAF: Outlook and potential

2012:
- Three rounds of testing; first round (Rope Pump) just finalized; 1st review workshop (29.5.-31.5.) → Final version by Jan 2013
- Peer Review of Draft TAF by various key WASH actors

2013:
- Finalizing TAF including IT Version
- Embedding and sector recommendation in the three countries

What is needed:
- **Match funding**, to allow development of roll out of a “product”
- **Support** to introduce the TAF to key actors in the sector such as development partners, governments, multilateral activities and in other initiatives
For more information

On WASHTech in general:
http://washtechafrica.wordpress.com/

or

On TAF / Methodology:
andre.olschewski@skat.ch
Thank you
Experiences with Conventional Rural Water Supply Systems

Main concept pursued: VLOM (Micro-level approach)
- Supply of handpumps for small communities,
- Improvement of wells operated by individual households (self supply).

Project characteristics:
- Heavily subsidized donor driven projects,
- Little consideration of national policies,
- Low water usage fees,
- Too little consideration of maintenance for long term operation.

Experiences with Solar Pumping Systems

Application Range:
- Handpumps are least cost option up to 25m³ per hour,
- Motorized pumps are needed for higher pumping energies,
- PVP is mainly competing with Diesel pumping systems

→ Economic Viability of PV Pumping depends on local cost for diesel fuel and prices development of PV components

Development of Prices for PV Modules, Installed Roof-top Systems and Diesel Fuel
Comparison of Life Cycle Cost of a PV vs Diesel System

Comparison of Life Cycle Cost of a PV vs Diesel System

Solar Pumping

Diesel Pumping

Known Problems of PV Pumping

- PV/P is a mature technology with very low failure rates. Mean time to failure rate of PV components is almost 9 years.
- Water distribution components are more prone to failure and can lead to the collapse of whole systems (MTTF 2.3 years).

Broken Water Taps

30%

Pump Failures

27%

Pipe Leakages

18%

Inverter Failures

16%

Fences

1%

PV Panels

5%

Water Tank Leakages

3%

PV Panel Theft

5%

Frequency Converter

7%

Pump Failures

8%

Water Distribution Network

36%

Purification System

12%

Dry Well

21%

Well Output

7%

Water Tank

3%

Thailand

Evaluation of 500 PVP Units

40% out of operation after 6 yrs due to inadequate post project support

Morocco

49 PV units within 200km evaluated after 12 years, 100% still operational, maintenance system available

Recommendations

Increase Support to Governments in Creating Enabling Environments for Rural Water Supply Development

RWS projects need to be embedded in government policies
Role of donors: support the creation of enabling environments (includes licensing, concessions, permits, pricing mechanism, capacity building, incentives, financing schemes, quality assurance, technology advice etc.)

Attract Private Investors to Leverage Available Funds

Where an enabling environment allows private investors to achieve adequate returns up to 70% of required investment can be raised from the private sector.

Recommendations

Develop Rural Water Supply Projects at Scale

Sustainable operation requires maintenance service providers. This requires a critical number of pumping systems in a region making repair services economically feasible. To operate on a financially sustainable basis, a maintenance service provider should be able to achieve an annual turnover of the order of USD 50,000 to USD 60,000.

Base Investment Decisions on Life-Cycle Cost of Rural Water Supply Infrastructure

Investment decisions taken on the grounds of initial investment costs result in too high operational costs for rural communities. Sustainable operation requires low life-cycle costs.
Recommendations

*Consider the whole Water Chain to Guarantee System Reliability*

PVP technology has very low failure rates. Where PV contractors are not in charge for the whole water chain, system break downs are often related to leaking tanks, pipes, or broken taps.

Contacts

Thomas Meier – tmeier@bluewin.ch
Fredy Wirz – wirzsolar@bluewin.ch

Further Steps

To contribute to more sustainable rural water supplies through a growing number of productively used solar powered water supply systems.

**Techno-Economic Reference Document**
- Information for potential local investors (but also practitioners and donors);
- Technical solutions, design parameters, system cost, and opportunities for revenue generation;
- Case studies: e.g. irrigation systems for vegetable productions.

**Training Modules for Local Technicians and Field Practitioners**
- To be used in technical training
- Addressing technology, applications, O&M, financing, economics
Waterprojects with solarpumps in rural communities and periurban areas in Mali
by F.Wirz, Wirz Solar Gmbh, Sissach, Switzerland

Drinkingwater

mainly for village watersupply (mixed applications)
medium systems (0.8 – 2.8 kW PV capacity)

Solar waterpumping for foodproduction
cattlewatering etc

mainly for agricultural production (vegetable perimeters) and
small systems (0.3 – 0.6 kW PV capacity)

Examples for productive applications: vegetableproduction in Mali
for small farmers and women’s associations in the periurban area of Bamako

Visit of a FAO delegation at the solarpump demo site of the malian Ministry of agriculture MAG (PCDA programme for agricultural competitiveness and diversification, WB supported)

Installation of a solarpump system combined with a dripirrigation system in Torokoro, Central Mali

Solar pumping in combination with dripirrigation improves considerably the use of precious water in the Sahel, Torokoro

With this mobile pumpunit (circa 5400 US$) the women’s association with 122 members in Dona (near the city of Segou, Mali) made a net profit of 32’000 US$ in the first year of production 2011

Water is life... improved livelihood, less poverty with solar energy (less productioncosts, no CO2 emissions, multiple use of solar modules, Syn, near Djenne)

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Water is life... improved livelihood, less poverty with solar energy (less productioncosts, no CO2 emissions, multiple use of solar modules, Syn, near Djenne)
Solarpumping is finally known to be "technically and economically feasible", "cheap" and "economically more feasible than manual water lifting" especially for agricultural production as e.g. vegetable production or cattle watering it is very profitable.

(technical and economical details etc see in the attached ICRISAT/AVRDC study for Niger, where the same units we install have been used!)

Why is it then still so difficult to convince actors as investors, aidagencies, NGO's, microcredit lenders (FMI's), international and national agricultural support-programmes (IFAD, FAO), development programmes (UNDP) etc to invest together with the smallfarmers massively in such sustainable technologies (tools) which increase jobs, foodproduction, foodsecurity, which improve nutrition and fight poverty with additional revenues, which minimize CO2 emissions and mitigate effects and adapt populations to climate change to support millions of smallfarmers
Some reasons and assumptions to discuss and actions to take:

- It seems that these actors do not know these informations yet... (?)
  - Then we have to close this information gap urgently with public information campaigns.

- It seems that many users are not sufficiently trained for operation and maintenance...
  - Then we have to increase the number of training programmes for the various actors as e.g. local technicians, operators, water committees etc.

- It seems that there are not enough support infrastructures with spare parts and locally trained staff around to make the installations run sustainably
  - Then governments and private sector have to set up such support infrastructures (PPP’s).

- Some small farmers and women’s associations have found out that these tools are necessary to lift them out of poverty.
  - They have to spread the news and make pressure to the politicians to arrange the necessary financial systems to get access to these tools.

- Further issues to be discussed.....

- Thank you for your attention!
Meeting Aguasan 2012 - Bern
Christophe Grange

Mission and Vision

- Water Traid (Suisse) SA based at Y-Parc, Yverdon les Bains
- Production, distribution, technology transfer, technical expertise in the field of drinking water targeted to developing countries and emergency situations
- Promote and support local and independent distributors network from Water Traid Ghana
- Affordable prices and robustness of products

Water Traid Suisse

Water Traid Ghana

Clients and Partners

- Ministry of Health, Water and Environment
- NGOs: MSF, CARE, OXFAM, ACE etc.,
- International organisations: UNICEF, OMS, UNHCR, ICRC, IFRC, UNEP, UNDP etc.,
- Private companies
- Factories, agriculture, etc.,
- Training centers

Products and services

- Testing
- Treatment
- Distribution and Storage
- Technical Expertise
- Training
**Products**

- **Testing:** our flagship products!
  - WSL50
  - WSL25
  - WSL20
  - WSL10

- **Treatment**

- **Distribution and Storage**

**Innovation**

- **Next Generation Kits**
  - Targeting the electrical independence with incubators using the phase change material (PCM) technology
  - PCM technology principle

**Conclusion**

- Water Traid Suisse and Ghana are operational from June 2012
- Distribution network is already in place
- Flagship products are existing and ready to be produced and assembled in Ghana
- Research project (CTI) to develop the next generation kits
- Promoting innovative and sustainable technologies to satisfy drinking water needs

**Contact**

Christophe Grange (General Manager)
Tel: +41 79 101 01 37
Email: christophe.grange@water-traid.com

Address:
Y-Parc, rue Galilée 9, 1400 Yverdon-les Bains
Rainwater harvesting as an adaptation strategy: Colombian examples.

Margarita Pacheco
margapacheco@gmail.com

Colombian Institutional Framework for Adaptation to CC

Law 1523 April 2012: Disaster Risk Management Policy

National Adaptation Plan: searches to reduce vulnerability in population, ecosystems and productive sectors

NAP aims at strengthening capacity to respond to extreme weather events

NAP will develop territorial and sectorial plans

Climate Change National System in the National Development Plan:
Territories and Productive Sectors must internalise cc problematic generate their own adaptation and mitigation mechanisms

National, regional and local institutions dealing with adaptation:
DNP, MADS, MADR, Unidad Nacional de Gestión Riesgo, IDEAM, CARs, municipalities, (Bogota, Medellin, Pereira, Manizalez, Cartagena, academic institutions, NGOs, community based organisations…)

Institutions dealing with integrated water resources management: dispersion in sectors and territorial levels

Rainwater multi-purpose utilisation requires new institutional arrangements at all territorial levels
Territorial and Sectorial Adaptation Strategies

Integrated Rainwater Management Policy

- POMCA & POT risk and water management analysis
- Case studies (different ecosystem & biodiversity contexts)
- Institutional strengthening of regional and local authorities in adaptation to climate change
- Risk and water management analysis
- Institutional strengthening of regional and local authorities in adaptation to climate change
- Integrated Rainwater utilisation in different regions

Integrated Rainwater utilisation in different regions

- Descentralizar política publica de aguas, conciliar necesidades de comunidades e intereses empresariales: Acueducto y Alcantarillado.
- Reconocimiento a prácticas culturales, vulnerabilidades regionales, efectos de eventos extremos
- Diseño de marco normativo en bosques tropical húmedo: seguridad alimentaria, salud pública, ecoturismo, iniciativas empresariales
- Oficio: “Gestores de Agua Lluvia diplomados regionales del SENA
- Subsidios para mejoramiento de vivienda
Integrated vision: associated services to Rainwater utilisation
an income generating activity

Knowledge transfer
(ceramic filter production in Cambodia,
Women cooperative production in Providence
Island, Colombia)

Rainwater Environmental services
energy production, aquifer recharge, food security

Flooding & draught prevention

Risk management strategy

- Use the water cycle to our favor...in each productive sector
- Incentives
- Integrating urban run-off to risk prevention
- Reduce solid waste in drainage systems
- Restoration of catchment areas and biodiversity
- Divulgate your
- Capacitation

Entender ciclo del agua en cada sector productivo,
recompensar el uso y conservación de la biodiversidad.
Incentivos.
Integrar las corrientes urbanas para la prevención del riesgo.
Reducir los residuos en los sistemas de drenaje.
Restauración de cuencas y conservación de la biodiversidad.
Divulgar y Capacitar.
Risk management strategies

• Planificar localmente la Adaptación para confrontar vulnerabilidades, incertidumbres y variabilidad climática

• Reducir contaminación de costas y mares
Separación de Aguas pluviales y aguas grises drenadas por las ciudades, sedimentos de deforestación, agricultura, ganadería, minería, agroindustrias

• Disminuir caudales, prevenir enfermedades asociadas al agua
El Agua lluvia al final del tubo, maltratada, contaminada, sedimentada, turbia, “pavimenta” el lecho del río; desbordamientos e inundación

Rainwater for domestic uses
a human right – a public good
colombian examples in arid and semi-arid areas

➢ The patio: historic example for rainwater collection
➢ Well preservation
➢ Multiple domestic use
Rainwater for domestic and social cohesion
a cultural adaptation strategy
Example in insular contexts where surface water is scarce & polluted

OTHER EFFICIENT SYSTEMS

Uso de energía solar y Agua Lluvia- reutilización de botellas plásticas desechables
Agua caliente para duchas Sistema Sodis

Captación de Agua Lluvia donde el agua subterránea y superficial son escasas
Represa en superficies rocosas: prevención de hambrunas y sequía (Rock catchments en Masai land, North Kenya, 2005)
Recommendations

- The Colombian Green Building Code should include municipal regulations for rainwater multi-purpose utilization

  Municipalities, Regional Environmental Authorities & Academia should strengthen research to adapt rainwater technologies to different ecosystem climate conditions

  Mapping and evaluating rainwater cultural practices and progress made in adaptation, according to national policy frameworks (bottom-up to adjust national policy)

  Post Rio+ 20 should monitor territorial and sectorial adaptation based on rainwater utilization
SDC’s updates on the 0.5 Fund

Aguasan meeting, June 2012

Objectifs du Message 0.5%

Répartition des engagements

Annexes: 113 Aguasan Meeting June 2012
Basis - Results

**Action line 1**

- The SDC will help to increase the capacities and responsibility of institutions concerned with the management of water catchment areas and transboundary catchment areas. Furthermore, instruments for better global water management are to be tested and enhanced in three major river basins.
- The "Water Footprint" project is to be expanded in partnership with Swiss companies from Colombia into another country, and the experience gained with these projects will feed into subsequent ISO standards.
- The creation of a "Swiss Water Partnership".

**Action line 2**

- Thanks to sustainable water management, approximately 1.5 million people in rural areas and small towns will have access to clean drinking water and basic sanitation facilities.
- 400,000 households in rural areas will receive domestic water disinfection systems (WATA).
- The innovative "Blue School" concept is equipping more than 400 rural schools (with over 80,000 pupils) with drinking water systems, separate toilets for boys and girls, vegetable gardens with small-scale irrigation system.
- At least two national hand-washing campaigns are being launched.
Basis - Results

Action line 3

- 350,000 poor farming families now have secure access to water and are able to irrigate their fields using an efficient system that is also environmentally friendly thanks to the latest technology.
the Swiss Bluetec Bridge

SDC Water Initiative

Naissance d'une Start-Up le vide financier entre sources de financement publiques et privées

3 milliards
Fond national de la recherche

200 millions
Fonds nat de recherche
Commission pour la technologie
HEI

Fonds de démarrage
Commission techno & innovation

4. installation pilote

5. certification, mise en exploitation

FINANCEMENT PRIVE

Fonds de micro finance
Capital risque
Banque d'investissement
Business angels
Swiss **Bluetec Bridge: Pourquoi ?**

**Objectif**
Bluetec = instrument d’accélération pour l’accès durable à l’eau pour le bas de la pyramide (pauvres, ruraux)

**Stratégie**
Instrument pour amener les technologies innovantes à maturité
Remplit le vide financier entre prototype et diffusion

**Validation**
Pertinence et adéquation confirmée auprès des acteurs (faïabilité): WIs déjà sollicitée par start-up et institutions financières & fondations privées et soutenu par CleantechALPS

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Swiss **Bluetec Bridge: Processus**

Processus géré par une *Unité Opérationnelle*
(institution sélectionnée sur appel d’offres)
qui gère notamment un Comité de sélection + Coaches

**5 Étapes**
Appel à proposition – Présélection - Sélection – Cofinancement – Suivi/Evaluation
Swiss Bluetec Bridge: Extension

Possibles développements
Ouverture des projets/start-up:
Suisse -> Pays du Sud & émergents

Type de technologies:
eau productive, assainissement

(Cibles fixe):
Rural pauvre

Financement du Bluetec Bridge:
Ouverture du cofinancement (par ex fondations)
Risques:
Au pire opération neutre!

Couverture assurée:
Chaque projet doit couvrir un minimum de 5'000 personnes en termes d’approvisionnement en eau

Investissement DDC: CHF1'500'000,
Investissement total CHF 3'000'000 (50%-50%)

30'000 personnes couvertes pour CHF 3 millions : 100 CHF/personne
Si 50% de réussite
15'000 personnes couvertes durablement neutre
AGUASAN WORKSHOP SERIES FOLLOW-UP

AGUASAN Workshop 28 – June 18-22, 2012

AGUASAN…

- … an interdisciplinary Swiss CoP bringing together a wide range of specialists to promote wider and deeper understanding of key issues in WASH in developing and transition countries.
- … provides since 1984 a functioning multi-stakeholder platform serving the sector and constitutes an essential link in SDC’s thematic knowledge management strategy.
AGUASAN Workshop cycle and steering

- **Workshop preparation & steering committee for 2012:**
  - Manuel Thurnhofer (SDC)
  - Agnès Montangero (HELVETAS Swiss Intercooperation)
  - Chris Zurbrügg (Eawag/Sandec)
  - Ulrich Graf (SHA / AWA Kt. Bern)
  - Roger Schmid (Skat)

- **Yearly SDC mandate to Skat**
  - Leading the preparation/steering committee in developing the workshop content/process and in conducting the event
  - Organisation and logistics
  - Evaluation and reporting
  - Workshop secretariat (Norolalao Robson)

AGUASAN Workshop topic 2012

**FINANCIAL SUSTAINABILITY OF WASH SERVICES**

*About mindset change and an eye for the future*

“*What kind of change in mindset is required to achieve long-term financial sustainability of rural and small town WASH services – what will it take and how can it be achieved?*”

- Learning from established practices and tools for better financial planning:
  - What are the costs components that need financing in the life-cycle of sustainable WASH services and how to value them?

- Exploring innovative financial mechanisms for capital investments:
  - How do different financial sources and mechanisms for capital investment influence the sustainability of WASH services?

- Enabling approaches improving financial sustainability of operations:
  - How can effective and efficient operation of WASH services contribute to their long-term financial sustainability?

- Comprehensive financial sustainability framework for WASH services
- Generic recommendations and individual take-away messages
**Workshop concept / process**

- **AGUASAN Workshop 28 (2012)**

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**Resources and features**

- **45 participants** bringing in their personal experiences and expertise in plenary, working groups and peer assist clinics
- **2 resource persons:**
  - Guy Hutton (consultant): “Valuing costs/benefits in support of advocacy and fundraising”
  - Peter Burr (IRC WASHCost): “Experiences with the Life-Cycle Cost Approach”
- **5 topic cases:**
  - Ramiz Kokollari (KIWER): “Sustainability challenges of Kosovo rural water sector”
  - Cesarina Quintana (SDC): “Financial sustainability in scaling up the SABA Model Peru”
  - Arjen Naafs (IRC WASHCost): “The use of the life-cycle cost approach in Mozambique”
  - Monique Gbaguidi (Helvetas): “Mutualisation de la gestion des ouvrages simples Bénin”
  - Amisial Ledix (Helvetas): “Financial sustainability of WASH services in Haiti”
- **Training:** ½ day primer / crash course life-cycle cost approach (IRC WASHCost)
- **Excursion:** Financing solid waste management in Switzerland (input from AWA Kt. Bern followed by field visits AVAG)
- **Interaction** with invited guests from SDC/AGUASAN on preliminary results
- **Facilitator/co-facilitator:** Riff Fullan / Nara Weigel (HELVETAS)
- **Rapporteur:** Anne Sophie Aublet(Skat)