

## Combined household water treatment and indoor air pollution projects in urban Mambanda, Cameroon and rural Nyanza, Kenya



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# **Combined household water treatment and indoor air pollution projects in urban Mambanda, Cameroon and rural Nyanza, Kenya**

**Report of a mission to Mambanda, Cameroon and Nyanza, Kenya  
Carried out from 10 to 18 December 2009**

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## ***Acknowledgements***

The authors thank the project officers and health promoters, government officials, small-scale business people and household respondents in Cameroon and Kenya who offered their time and expertise to inform this evaluation. In addition, appreciation is extended to all those stakeholders who helped initiate these household environmental health integration projects and continue to carry out this important work.

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## ABBREVIATIONS

ACMS	Association Camerounaise de Marketing sociale (Social Marketing Association of Cameroon)
ALRI	Acute Lower Respiratory Infection
AQG	Air Quality Guidelines
GTZ	Gesellschaft für technische Zusammenarbeit (German Technical Cooperation)
HAP	Household Air Pollution
HHE	Household Energy
HWT	Household water treatment
HWTS	Household water treatment and safe storage
IAQ	Indoor Air Quality
ITN	Insecticide treated nets
LP	Liquefied petroleum
JMP	WHO/UNICEF Joint Monitoring Program
MMS	Mambanda Multi Stove (Cameroon)
NGO	Non-governmental Organization
NICHE	Nyando Integrated Child Health and Education Project
PCIA	Partnership for Clean Indoor Air
PSI	Population Services International
RFP	Request for proposals
SWAP	Safe Water and AIDS Project (Kenyan NGO)
SWAp	Sector-wide approach (Kenyan Government)
UNICEF	United Nations Children's Fund
WG	WaterGuard® ("Sur'Eau" in French)
WHO	World Health Organization

## **EXECUTIVE SUMMARY**

### **1. Background to RFP**

In 2007, the World Health Organization (WHO) issued a request for proposals (RFP) on the integration of Indoor Air Quality (IAQ) and Household Water Treatment (HWT) at the household level in Africa. Globally, the burden of ill-health in Africa due to unsafe drinking-water, inadequate sanitation and polluted indoor air stands out prominently. Among African children under 5 years of age, 18% of all deaths are due to diarrhoea, and 17% to pneumonia (UNICEF/WHO, 2009). Around 40% of these pneumonia deaths can be attributed to indoor air pollution, and approximately 88% of diarrhoea deaths to inadequate water, sanitation, and hygiene (WHO, 2007).

The aims of this initiative were:

1. To explore whether or not it is possible to achieve synergies and economies of scale by linking HWT and IAQ interventions
2. To examine the potential for expansion and scaling up in the implementation of projects combining these interventions
3. To document integration models for these interventions
4. To examine the added-value of integrating these two approaches, in a way that contributes to an improvement in health outcomes, as well as sustainability and adoption of use.

Following appraisal of the proposals received, two projects were selected, one in urban Douala, Cameroon, the second in rural Nyanza, Kenya. A brief overview of each project is provided in the country report sections in the main report.

### **2. Evaluation Terms of Reference (ToR) and methods**

WHO project support in the overall management plan made provisions for an evaluation visit to each country. These were carried out in December 2009 by two WHO Consultants, Mr Ameer Shaheed (Cameroon and Kenya) and Dr Nigel Bruce (Kenya), with the following ToR:

1. Prepare background information and compile contextual information on the areas/study communities with respect to water supply/quality, household fuel type and supply/IAQ (subject to availability) and related health data (diarrhoea, acute lower respiratory infection (ALRI))
2. To conduct a field-visit to the two projects in Cameroon and Kenya, and perform a basic evaluation
3. Prepare a comprehensive factual account of project activities and outputs, describing the experience of residents, project staff and other relevant key informants (e.g. local government, partner organizations) concerning project delivery, achievements, problems and issues, and concerning future prospects for this combined environmental health approach targeted at households. Particular emphasis should be given to assessing the added value of linking drinking-water safety and indoor air quality.

The methods used for the evaluation drew on techniques of rapid appraisal, involving (i) review of **Documentation** (all available project documentation, country statistical data, relevant published papers and reports; (ii) **Interviews** with key informants (project staff, residents/users of the products and services, and other stakeholders), and (iii) **Observation** (project management and procedures, households, photographs). Interviews were recorded by manual note-taking, and responses synthesized using a simple form of framework analysis. The background paper in the RFP by Clasen and Biran (2007) which proposed criteria on potential synergies and antagonisms, also contributed to structuring the evaluation.

### **3. Country Reports**

#### **CAMEROON**

##### **Local situation**

Cameroon is a country of 18.2 million people. Mean life expectancy at birth is 50/52 years (m/f), and under-5 mortality is 149/1000 live births. Diarrhoea accounts for 16.4% of under-5 deaths, and pneumonia, for 20.4% (WHO, 2009). According to 2008 figures, an estimated 92% of urban Cameroon has access to an "improved" drinking-water source as defined by the WHO/UNICEF Joint Monitoring Programme (WHO/UNICEF, 2010). This does not guarantee safe water however, and a large proportion of such sources may be subject to contamination especially through unsafe water handling and storage practices. Additionally, 56% of urban areas lack access to "improved" sanitation (WHO/UNICEF, 2010). Regarding urban fuel use, approximately 52% consists of wood and sawdust, 25% of LPG gas, 5% of charcoal, and 13% of kerosene (WHO, 2010).

The project was spearheaded by the German Technical Cooperation (GTZ) in Cameroon, in Mambanda, a semi-formal settlement in Douala, Cameroon's largest city. Situated on an island, access to water is limited, and groundwater is brackish, containing heavy iron deposits. Furthermore, the poor system of pipelines and management of treatment plants results in contaminated, unsavoury, and insufficient drinking-water. Fuel use consisted primarily of wood and sawdust, and to a lesser extent, charcoal and LP gas.

##### **Project activity and achievements**

###### *Project objectives*

The project piloted a method of integrating the delivery of a water treatment device with improved stoves. It was set up to investigate the potential added value of combining environmental health interventions. Its health aims were "to reduce child morbidity and mortality from diarrhoeal and respiratory diseases" (GTZ, 2008). GTZ also saw this as an opportunity to follow from their earlier activities in water, sanitation, and hygiene in Mambanda.

###### *Project functioning*

The project was coined "Smoke and Drinking-water", which saw the joint implementation of a water treatment product "WaterGuard®" (WG) and an improved stove "Mambanda MultiStove" in eight blocks of the settlement. WG is a sodium hypochlorite solution used for disinfecting drinking-water at the point-of-use, popular in many African and Asian countries and emergency-relief operations. The Mambanda MultiStove (MMS) is a unique improved stove, designed by GTZ, aiming to reduce indoor-air-pollution and efficiently combust



multiple types of fuel. The project was set to run from June 2008 to November 2009. It was in succession to GTZ's earlier "Water and Sanitation" project (2006-2008), in the context of which well-chlorination and sanitation interventions were conducted in several parts of Douala, including Mambanda.

#### *Project structure*

The GTZ environment health officer in Douala was the overall project coordinator. He employed two project managers, who were in charge of all field activities. The *Association Camerounaise pour le Marketing Social (ACMS)*, a not-for-profit organisation, provided WG and social marketing expertise to the project. Local welders were trained by GTZ to produce the MMS. The project team included four local groups: (1) water vendors, who sold water at communal pumps along with both intervention products; (2) local shopkeepers who sold WG; (3) community workers who engaged with the beneficiaries and sold both products; and (4) local health centre staff.

#### *Expected outputs*

Of the target population, 90% was expected to have access to safe drinking-water and 60% to be using fuel efficient stoves by the end of the project. The integrated approach was expected to bring overall efficiency, particularly in cost and time. They expected improvements in community health education, and greater ownership of the project amongst beneficiaries.

#### **Evaluation results**

It is important to note that the focus of this evaluation was to study the potential for integrated household interventions, as opposed to the effect of the specific interventions in question. The evaluation was conducted by rapid appraisal methods, including key informant interviews. All quantitative data was obtained from studying reports submitted by GTZ after our evaluation.

A series of events – mostly beyond the control of the project managers – affected the project over its course. This led to some difficulties in the interpretation of available data on the project implementation and impacts, issues which are discussed further in section 2.2. Due to this, and to a focus that was more geared to assessing integration *per se*, our conclusions and recommendations draw substantially on the visit, with support from reports and data where this is available.

The following are key results that emerged from the evaluation exercise:

#### *Community response*

There was clear support for the intervention amongst the study group and neighbouring residents. Both beneficiaries and project implementers found the integration of health interventions to be efficient and effective. A significantly raised awareness of the project and general health was reported. The greatest complaint regarded stove prices, which were too expensive for most members of Mambanda, and sold best when subsidized.

### *Implementer benefits*

The main implementer benefits included consolidating awareness campaigns, implementation and data collection, reaching a greater target audience and promoting preventive action for both ALRI and diarrhoea with a single theme (the kitchen).

### *Target population benefits*

Two products being promoted at once (time saved), a more consolidated/holistic understanding of health and a potentially more enduring message were the key benefits to the project beneficiaries.

### *Trained community workers*

The trained local community workers, who promoted and sold the products directly to households, play an important role in generating interest and demand for the products. They imparted a feeling of familiarity and trust, and bridged the divide between implementers and community.

### *Quantitative impact*

The short duration of this pilot study did not allow for collecting sufficient data to quantify the impact on health from the intervention technologies. It was also not possible to numerically demonstrate an increase in sales and uptake specifically due to the synergy. There was little data on compliance, hard measures of uptake or of 'treatment' effects (e.g. chlorine residuals, air pollution measurements), or health improvements in relation to either product. However, reported use of WG for water treatment rose from 1 to 34% for the intervention households, and there was an increase from 1 to 12% in MMS stove use in those same households. During the project 220 stoves were sold to individuals located in the intervention area while 442 were sold to individuals outside the intervention. Although the reasons for greater sales outside Mambanda have not been specifically investigated, anecdotal accounts indicate that the stoves were unaffordable in Mambanda, even with the 30% subsidy. However, wealthier households outside Mambanda could afford the stoves and found them technologically superior to other stoves on the market.

## **Discussion**

The combined approach of environmental health interventions was received well by implementers and beneficiaries alike. Key gains noted by implementers included efficiency on several fronts (e.g. number of community interventions, time, cost), and improvements through consolidated promotion. Key difficulties arose in respect of affordability of the interventions (principally the stove), funding, and in managing project sustainability in the face of challenging local circumstances. Price was an important barrier to the sale of MMS, which nevertheless benefited from considerable awareness and interest. The project would have benefitted from more systematic and detailed monitoring and evaluation.

In considering the delivery of combined interventions, we found an analysis of motivational factors to be important. The indoor air quality component of the intervention saw perceived benefits such as efficient fuel use, a cleaner cooking environment and visible smoke reduction. Use of water treatment on the other hand seemed more due to a raised awareness, and health- and hygiene-based behaviour change. These two interventions, with different motivations, were packaged under a common theme: the kitchen. This theme

worked well in the given setting, and effectively joined the two interventions. Recognizing motivational factors and finding effective promotional messages/banners thus seemed to be a pertinent consideration.

One of the most important links in respect of behaviour change, imparting education, and putting theory into practice, was the role of the local community workers. Their credibility and knowledge of the local area was essential to effectively target individuals, values and behaviours. They also formed an important link between the community, project team, and other stakeholders. Of most interest, the workers were all associated with a “brand” of sorts, known as “Mami Pegna”. “Mami Pegna” (roughly translated as “Mother Ideal”) represented a village woman who embodied virtue, and good living practices (e.g. hygiene, health, and with connotations of good morals). The community workers were identified as Mami Pegna, and wore customized t-shirts with her logo (see Section 2), and were well-known across Mambanda. This unifying concept was an effective mechanism to bind both (and several other) interventions together.

The specific impact of the technologies that were promoted requires further investigation, as data collection, extenuating circumstances, and time were restricting factors. From our analysis, greater awareness and uptake of both products was observed. Interviews revealed greater health awareness, and hygiene practices. Beneficiaries reported improved health from using WG, and were generally satisfied with the product despite the ill-fitting bottle caps (discussed further in Section 2.3). Indeed, the majority of community members interviewed indicated a wish to have continued, and for greater access to such products. Although price was a major barrier, the versatility and technological value of the stove made it particularly popular, with a few stoves even being sold outside Douala.

Regarding next steps for investigating integrated models, two priorities emerged in particular from the Mambanda work. The first was to carry out further assessments of such projects, designed to tease out specific “added value” of joint projects over separate ones. The second was to clearly define the scope of integrated intervention programmes and identify their specific components, determining the specific types and number of interventions that would be appropriate for given settings.

This project also illustrated the importance of developing workable governance frameworks for scaling up household- and community-level projects. These need to include a role for government alongside multiple stakeholders (including private companies) down to the community level. It is also important to consider different financial models to make such an integrated approach sustainable for all parties involved (notably suppliers and low-income end-users).

### **Principal recommendations for the Mambanda project**

The major benefits of this synergistic approach are applicable to a range of environmental health interventions at the household level. The following are specific recommendations for improving and scaling the project in Mambanda. In order to expand activities, the following three major recommendations are given:

- *Overall follow-up/project re-establishment*  
An assessment of the current situation, given the cessation (at this time) of the project would be an appropriate first action. Initial tasks would include ascertaining which of the partner organizations are still operational, other available partners, and the status of the former Mambanda water and sanitation committee.
- *Support for a local water, sanitation, and indoor air committee*  
Approaches to involve all stakeholders in a viable manner are required. For its duration, the community committee seems to have been successful. Given the household level of these interventions, such a model may still be appropriate. The active participation of local government would also be a factor to include, together with other higher-level support.
- *Resource mobilization/financial mechanisms*  
Along with governance, finance is an important element to sustainability. Solutions to make the intervention financially viable are needed. In addition, reducing the capital cost to the households while providing ongoing incentives to local implementers and suppliers is crucial.

Future assessments to further investigate the issues explored in Cameroon include:

- Compliance with WG, using measurements of chlorine residuals
- MMS uptake (including demographics of intervention households)
- Efficacy trials of MMS including emission, household air pollution levels and fuel efficiency, and possible alterations to improve performance and reduce air pollution.
- Epidemiological studies for both WG and MMS users (with appropriate control groups), as a longer term evaluation objective.

## **KENYA**

### **Country situation**

Kenya is a country of 38.8 million people, of which 68% are classified as rural (WHO/UNICEF, 2010). Neonatal mortality (33/1000 live births) and under five-mortality (128/1000 live births) are still relatively high and diarrhoea and pneumonia are the predominant causes of death in young children (WHO, 2010). These two illnesses are responsible for around 16% and 17% of these deaths, respectively, in 2004 (UNICEF/WHO, 2009).

The most recent JMP data indicates that in rural Kenya over half (52%) of households had access to "improved" water sources in 2008, which is substantial increase from 30% in 1990 (WHO/UNICEF, 2010). The most recent figures from the WHO household energy database show that in 2003 almost all (96%) of rural homes used solid fuels for cooking, most of which is wood (85%), with some charcoal (10%) (WHO, 2011). Less than 5% of these solid fuel users have stoves which vent smoke through a chimney.

Given this situation with respect to health status and to water and energy access in Kenya, together with the importance of both safe water for diarrhoea prevention and reduction of solid fuel smoke exposure for pneumonia prevention, effective interventions addressing both

of these problems are highly relevant. The potential of such programmes for scaling up is of vital importance, if initiatives such as the project evaluated here are to make a substantial contribution to reducing the population disease burden arising from unsafe water and solid fuel use.

### **Kenya project activity and achievements**

#### ***Project objectives and expected outputs***

The following objectives and outputs were stated in the SWAP project RFP application:

##### **Goal:**

The goal of the project is to reduce the risk of diarrheal diseases and respiratory infections by motivating the use of household water treatment (HWT) products and innovative stoves for improvement of indoor air quality (IAQ) in rural Kenyan villages.

##### **Objectives:**

- Demonstrate the integration of HWT and IAQ into 10 of 60 villages enrolled in an ongoing program motivating the purchase and use of health interventions through social marketing, community mobilization, and microfinance
- Motivate purchase and regular use of HWT products:
  - a) Increase use of HWT products from 15 to 40% of households in 10 intervention villages
  - b) Pre-filtration of water with simple sand filters in buckets in 25% of households in 10 intervention villages relying on turbid sources
- Motivate the purchase, production, installation, and adoption of IAQ technologies (either the Rocket Stove or Jiko Kisasa Stove) in 30% of households in 10 intervention villages
- Evaluate programmatic approaches, adoption processes, and aspects related to the maintenance and continued use of the interventions.

#### ***Project structure***

The project is run by a Kenya-based NGO, the Safe Water and AIDS Project (SWAP), based in Kisumu. Although the work of SWAP covers most of Nyanza province (and a part of western Kenya), the current project is restricted to Nyando district, south of Kisumu, bordering Lake Victoria. Two main components to the project are activity evaluated here:

1. The delivery of education and products (several water treatment and storage products, improved 'Upesi' stoves, insecticide treated nets, and other products including nutritional supplements) to households, using a commercial model that allows a modest profit margin for the vendors/educators.
2. An evaluation study managed by CDC and SWAP staff, the Nyando Integrated Child Health and Education Project (NICHE), covering 60 villages of Nyando, of which 10 received promotion of the integrated HWTS and HHE interventions. The research component includes surveys and bi-weekly surveillance, with assessment of intervention use, water quality (chlorine residuals, microbiology), indoor air quality, and the main health outcome (diarrhoea).

This is a well-managed project. It relies on vendors, using a sustainable commercial model supported by low-interest loans and innovative educational methods to empower low-income households with knowledge about how various products can improve health of families, and encourages adoption through example.

### ***Project functioning and achievements***

The vendors, local members of the communities drawn from HIV support groups and other community self help groups, are essentially running small-scale business operations facilitated by (relatively) low-cost loans, and are key to the functioning and success of this project. They work through community meetings and schools, and also directly by house-to-house visits, while some also sell in community kiosks and pharmacies. The SWAP vendors are offered training on safe water and business skills to help them to become more efficient in managing their small scale businesses including selling health products.

The promotion of products is commercially sustainable as these are sold at cost with a small mark-up for the vendors, although this is episodically compromised by free handouts by other agencies of water treatment products during floods and other crises. Overall, this appears to be an effective and robust model for sustainable delivery. Like all such NGO-led activities however, it was not entirely clear how well this system would 'survive' if SWAP funding and key, highly competent personnel were no longer managing the programme. Vendors are very committed, and recognize community demand, but are unsure whether they would still be able to access the products. The products themselves have the potential to impact on a range of high priority disease conditions for child survival in Kenya, namely pneumonia (Upesi stoves), diarrhoea (a range of HWTS products and hand-washing soaps), malaria (ITNs) and under-nutrition (Sprinkles).

### ***Water treatment and storage***

The HWTS products can be expected to be efficacious, but effectiveness depends on compliance in everyday use. Further data analysis is needed to complete the picture, but results available to date show compliance across the NICHE area to be moderate, reaching at best 66% reported use and 57% confirmed by chlorine residual testing in the 10 integrated project villages among improved stove users. On the basis of these data, the project has reached (and exceeded) the stated goal for HWTS.

This level of compliance may however be relatively good, in terms of what can be achieved in practice with HWTS. Although compliance appears to be highest where combined interventions have been promoted and adopted, this needs further analysis, adjusting for socio-economic and other confounding factors. It is also important to take into account the effect of participation in a study with frequent home visits which may inflate compliance in a non-sustainable way.

### ***Improved stoves***

The authors are not aware of any prior studies of the efficacy of the Upesi stoves, specifically in terms of HAP reductions in ideal ('test-house') circumstances. However, results from testing of indoor air pollution levels in the current project (repeated early in 2010) demonstrate very modest reductions in PM<sub>2.5</sub> of 10-20% at best. However, stronger evidence of savings in fuel wood of nearly 30% was reported. Based on everyday experience in the

project, however, these stoves appear to be well-liked and well-used, and are reported to save wood, reduce smoke and the consequent irritation, cough, headaches, etc., as well as the level of soot in the kitchen. Women have re-organised their kitchens in response to this, bringing pots and other utensils much closer to the stove. The reasons for this inconsistency between field experience (reported reductions in smoke and irritation) and test findings (for PM<sub>2.5</sub>) are not clear, as reductions in ambient kitchen PM<sub>2.5</sub> of somewhere around 40-50% (at least) might be expected given the reported improvements in the kitchen environment. The project team used an established protocol and equipment for making the measurements.

Information on the numbers of stoves adopted in each community, and hence level (%) of uptake, was not reported across the study area or available to us (although these data should be available to the project). It is therefore not possible to comment on whether adoption has met the target set in the project objectives. While effectiveness of the stoves remains open to question and will be further assessed once the new measurement results are available, the model of promotion and sale of a cook-stove product that is well-liked and used is an important achievement and of value for the future of the project.

### ***Synergies***

The approach of combining the promotion and delivery of HWTS and HHE products met with across the board positive responses. It appears more cost-effective than if the same products were promoted through separate programmes. Combined delivery may also achieve higher compliance, but this does need further analysis. There were no substantive concerns with any of the criteria identified from the background review paper.

### ***Impact on health outcomes***

Analysis of the results of the impacts of the interventions on diarrhoea and pneumonia incidence is awaited. It can be expected that the reported level of compliance with water treatment would have some impact on diarrhoea, particularly where the higher levels have been reached. On the other hand, the very modest reduction in PM<sub>2.5</sub> levels recorded for the Upesi stove would not (if confirmed) be expected to lead to substantial reductions in risk of pneumonia.

### ***Sustainability and scaling up***

With respect to the two linked issues of sustainability and scaling-up the outcome of the evaluation also is positive, although both depend to some degree at least on the existence and *modus operandi* of SWAP. The vendors spoken to said that they were committed to continuing their work, even if SWAP ceased operations, but only if they could still obtain the products. From the perspective of the SWAP management, the vendors are still dependent on SWAP's support with training, follow up visits, supply of products, motivating them with incentives and so on. SWAP itself is also still donor dependent, and has recently developed a business plan to raise its own income. However, given the fact that SWAP operates a similar methodology across its whole area of operations for delivering the water treatment, ITNs and other (original) set of products, it does seem reasonable to assume that delivery of these plus the stoves would also be possible across this much larger area.

To date, scaling up of the improved stoves across this wider area has been very slow, due to the need to scale up production, and also for training of installers. Consideration also needs

to be given now to the implications of the results of the Upesi stove evaluation, since although the stove is well-liked, affordable and clearly saves fuel, the reductions in kitchen PM<sub>2.5</sub> are unsatisfactory in terms of the hoped-for health benefits. The project needs to examine alternative stove options for this purpose, which could be promoted, at least initially, along with continued promotion of the Upesi. Despite this question regarding the most effective and appropriate stove technology, it does seem that there is potential to scale up the delivery approach across a considerably larger population.

### ***Coordination with government and other agencies***

In 2009, SWAP joined HENNET, a national networking organization for NGO's and Faith Based Organization which was established in 2005 and has 77 members. The mission of HENNET is to stimulate linkages and strategic partnerships among health NGO's, Government and private sector in order to enhance their responses towards health needs of Kenyans. This function, together with the recent election (December 2009) of SWAP to the board of directors, means that HENNET could make a valuable contribution to supporting co-ordinated, scaled up delivery.

### **Principal recommendations for the Kenya project**

- On compliance with HWTS, it will be important to conduct careful analysis to examine this stratified by socio-economic status, and for overall estimates to include adjustment for confounding.
- Based on the results of the Upesi evaluation studies, other stove options should now be evaluated prior to scaling up, probably in addition to continued use of the Upesi for the immediate future. Further advice should be sought on the question of how large a reduction in PM<sub>2.5</sub> will be deemed 'acceptable' for this purpose: some further discussion of this matter is included under general strategic recommendations, below. Any alternative stoves will need testing of both suitability (including affordability) and performance in terms of PM<sub>2.5</sub> reduction, and fuel efficiency.
- The team should obtain/calculate population-based data on uptake and use of Upesi stoves, across the 10 villages of the integrated study area initially, but also make provision for assessing stove uptake across the whole NICHE study area.
- A need was identified by the project to develop additional production centres for Upesi stoves. This should be reviewed in the light of future scaling up and promotion plans for this stove.
- Carry out further assessment of vendor stocks and constraints on obtaining stocks, and if necessary identify ways to address any limitations.
- Keep pricing under review, and assess – with appropriate cautions - the possibility of arranging some form of targeted subsidy for poorer families. Investigate some form of 'asset acquisition package' for households.
- [Unless already being done] Document education and product use in schools, and assess the impacts on behaviour, and if possible, health outcomes.
- Given the apparently strong potential for scaling up the delivery methods used by SWAP, an option appraisal for scaling up should be developed involving, SWAP, other organisations/agencies, HENNET, and relevant government ministries.

Additional detailed recommendations and suggestions are included in Section 5.1.2



#### 4. Overall strategic issues and recommendations

The experience from these two projects, in context of wider policy on addressing water and air quality, raises some general strategic questions for which recommendations are made.

- The positive experience from these two projects concerning the apparently clear benefits of delivering HWTS and HHE interventions in an integrated way has important implications for future programmes. Specifically, the key strategic question is whether integrated delivery should be the norm, rather than, as at present, the exception and only seen in a few innovative projects. In addition to HWTS and HHE, integrated delivery can encompass a wide range of priority public health issues, including malaria, nutrition, HIV/AIDS/TB, family planning, water, and hygiene promotion, with considerable potential for addressing Millennium Development Goals, particularly 4 and 5, among others. These are critical questions for next steps with this work, and one of the principal justifications for holding a workshop to consolidate and critically assess experience from these two projects, and ideally input additional relevant experience.
- In both countries, the situation in respect of access to safe water supply is very poor, and given this situation, HWTS clearly has an important part to play in public health policy. This point was clearly made by the WR (Kenya), Dr David Okello, not least due to the slow pace of work on providing access to safe drinking-water, even in urban areas in that country, and the continuing high incidence of cholera. It would seem inevitable however, that very active promotion of HWTS could at the same time reduce the imperative to make substantive progress with the provision of safe, treated water supplies to communities and households. This tension could be addressed by setting plans for HWTS promotion in the context of clear and ambitious targets and timescales for treated water supply to the areas and communities concerned. If this linkage was the norm, progress with both point of use and community treated supplies, could be assessed together.
- Identifying, implementing and scaling up household energy interventions that are highly effective in terms of reducing HAP levels and exposure, and are affordable and practical for the large numbers of poor homes most affected by this issue, remains a challenge. This is highlighted by the current project (specifically in Kenya where data on reductions in PM<sub>2.5</sub> are available), but it has been a common experience. If this matter is not to be a serious barrier to progress in many less developed countries, it is important to consider adopting, as mainstream policy, a phased approach to achieving reductions in HAP. In this scenario, initial interventions would, in addition to being affordable, safer, more fuel efficient and well-liked by users, also provide quite substantial but not necessarily optimal exposure reduction. Optimal exposure reductions will be defined by air quality guidelines (see below). Based on the repeated evaluation of the Upesi stove in Kenya, reduction in the 48-hr kitchen PM<sub>2.5</sub> concentration is around 10-20% at best, which – in the current state of knowledge – is considered insufficient for obtaining useful health benefits. This matter will however be the topic for further consideration and expert advice to the project. Unfortunately, to date, the HAP reduction with the MMS stove in Cameroon has not been studied, and this should be done as soon as possible. There is some encouragement for this pragmatic, phased approach from the exposure-response analysis from RESPIRE trial in Guatemala (Smith et al., 2011), which shows that a 50% reduction in exposure resulted in a useful reduction in child ALRI risk, even though

residual exposure levels are still high in comparison with WHO air quality guidelines (AQG). With this approach, however, it must be stressed that on ethical and equity grounds, the standard sought and longer-term target must be the same (low) levels for all, and that these targets must be derived from the WHO AQGs.

## **5. Next steps**

### ***Workshop***

The evaluation plans for the projects included the option of a follow-up workshop, with resources to support this. This would be very valuable for reflecting on the experience reported here, and planning a longer-term strategy to promote and evaluate the combined delivery of environmental health interventions at the household level. This proposal had the support of Dr David Okello (WR Kenya). Planning for this workshop will be carried out following consultation based on this report.

### ***Publication and dissemination***

This evaluation report will be made available through the WHO Departmental web sites (WSH, PHE). A joint set of web pages on integrated approaches would be a useful resource. In addition to project reports, scientific publications will be available in due course from the NICHE/SWAP project in Kenya. It would be valuable in the meantime to build on the experience of these projects, this evaluation, and the background paper by Clasen and Biran (2007), to prepare a publication to raise awareness of potential benefits of integrated delivery, experience to date, and future directions for policy and research.

### ***Key research questions***

The following areas for further research are proposed. The follow-up workshop will provide a good opportunity to identify and prioritise requirements for further research, and the preparation phase should include further consultation on these questions.

- In what situations are integrated approaches more or less suitable? Should integrated delivery be the norm, or restricted to special situations? Are there particular advantages in areas with highly stressed fuel and/or water supplies, or where climate change adaptation will be especially demanding?
- What types of interventions (e.g. HWTS products, improved stoves/ventilation/cleaner fuels, insecticide treated mosquito nets, hand washing soaps, nutritional supplements, condoms, contraceptive pills, sanitary towels) improved are most appropriate for integrated delivery)? Are there other interventions in the household setting aimed at priority health issues, not considered by these projects, which could or should be included?
- Does integrated delivery result in greater effectiveness, and economic efficiency, in respect of (i) compliance and (ii) health impacts? What research methods and studies designs will be most appropriate? See further discussion of this below.
- What is the role of the health system in co-ordinating, managing and delivering integrated programmes for improving the household environment, given the multi-sectoral nature of the problems and the frequent involvement of NGOs, and other agencies/donors?
- What are the most effective models for integrated delivery, including consideration of the role of local market systems, and involvement of communities and users?

- What financing arrangements, e.g. loans, subsidies, etc., are needed to support (i) delivery and (ii) users, and what approaches to managing these are most effective. These questions may not differ from similar questions for other examples of delivering products and services in poor communities, although the need to supply and adopt a combination of products may raise different issues.
- What additional issues for scaling up need to be considered for integrated approaches, over and above those pertaining to scaling up of other community health and development projects and programmes?

### ***Issues in evaluating the added value of integrated interventions***

The assessment of whether or not ‘synergies’ from the integrated delivery bring ‘added value’ in terms of health impacts (and the inputs, process and outputs that ultimately lead to health impacts), is complex. Robust quantification of added value for health outcomes – true ‘interactions’ resulting from the benefits of reducing diarrhoea and respiratory (and potentially other, e.g. malaria) morbidity at the same time – would be very complex and expensive, and likely require some form of factorial study design that very significantly distort delivery mechanisms and hence may have little relevance to actual effectiveness. A more efficient and practical approach may be to thoroughly assess process (efficiency, benefits to supply, business opportunities, users perspectives, etc.), as well as compliance with the interventions, and overall changes in morbidity rates.

### ***National policy framework***

Consideration needs to be given to how innovation in and adoption of integrated approaches to household environmental risk relates to national policy. This will include the formulation of new policies, the adjustment of existing policies and the harmonization of policies in different sectors. This could also be usefully linked to household horticultural water use for food security. The whole range of environmental health and nutrition interventions at the household level should be covered by such a policy framework, and lead to national guidelines for certification and quality control as well.

## **6. References**

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[Accessed 9 February 2011].

## **1. INTRODUCTION**

### **1.1 Project overview**

In 2007, an RFP was prepared by WHO for proposals integrating Indoor Air Quality (IAQ) and Household Water Treatment (HWT) projects at the household level in Africa. At a global level, Africa suffers most from the environmental risks of unsafe drinking-water, inadequate sanitation, and polluted indoor air. African children represent the greatest risk group in all these cases, with approximately 677,000 deaths due to unsafe water, sanitation and hygiene and 500,000 deaths due to indoor smoke in 2004, the latest year of available data (WHO, 2009). The aims of the project were:

- To explore whether or not it is possible to achieve synergy between linking HWT and IAQ interventions
- To examine the potential for expansion of implementation of said joint projects
- To document integration models for these projects
- To examine the added-value of integrating these two initiatives, in a way that contributes to an increase in health impact, as well as sustainability and adoption of use.

In consultation with AFRO and Country Offices, two proposals were chosen, one in Cameroon, and the other in Kenya. The Cameroon pilot proposal was submitted by the Health Programme of the German Technical Cooperation (GTZ). Fuel-efficient stoves and point-of-use chlorination methods have been introduced into an ongoing WATSAN project in Mambanda, an informal sub-quarter of Douala accommodating over 1250 households. The WATSAN activities include well-chlorination, latrine-building, health education, as well as wastewater and solid-waste management. The second proposal was submitted by the Safe Water and AIDS Project (SWAP), an NGO receiving support from the Centers for Disease Control (CDC). SWAP proposed to integrate IAQ and HWTS in 10 out of 60 villages enrolled in the Nyando Integrated Child Health and Education (NICHE) project in Nyanza province, Kenya. NICHE is a project attempting to increase access to water treatment, nutritional products, and insecticide treated nets.

The pilots had a timeframe of 18 months, from June 2008 to November 2009. It was envisaged to hold a follow-up meeting/internal evaluation/workshop at the end of this period, the objectives and activities of which are the subject of this document.

### **1.2 Evaluation Terms of Reference**

The evaluation of these projects, carried out by WHO Consultants (AS and NB) in December 2009, had the following objectives:

1. Compile and describe background and contextual information on areas/study communities in respect of water supply/quality, household fuel type and supply/IAQ (subject to availability), and related health data (diarrhoea, ALRI, etc)
2. To conduct a field-visit to the two projects in Cameroon and Kenya, and perform basic evaluation

3. Prepare a comprehensive factual account of project activities and outputs, including photographs, describing the experience of residents, project staff and other relevant key informants (e.g. local government, partner organizations) concerning project delivery, achievements, problems and issues, and future prospects. Particular emphasis will be given to assessing what added value is gained by linking water and indoor air quality.

### **1.3 Visit schedule**

Refer to Annex 1.

### **1.4 Evaluation methods**

Evaluation was based on rapid appraisal methods, incorporating:

- Review of documentation (data and reports on countries/settings, project reports, other relevant sources)
- Interviews with key informants, including project, community and others with relevant experience and perspectives
- Observation, dairy log, photographs.

For a list of main heading for the interview schedules used for (i) project staff/agencies, etc., and (ii) community members, See Annex 2. Interviews were recorded in the form of notes, and analysed/compiled using basic Framework Analysis, using headings informed by the initial objectives, and refined by themes emerging from the interviews.

The background paper in the RFP by Clasen and Biran (2007), which proposed criteria on potential synergies and antagonisms, was used to structure assessment in the current evaluation.

### **1.5 Brief review of literature**

#### **1.5.1 Effectiveness of HWTS**

The role and effectiveness of water quality interventions, particularly at the point-of-use, have been subject to much debate. To encompass the scope of the debate, this section will focus on recent systematic reviews. Drawing upon three different systematic reviews, Cairncross et al (2010) wrote the most recent paper on the comparative value of water, sanitation, and hygiene. Overall, water quality interventions resulted in 36-48% reductions in diarrhoeal disease. Furthermore, household-based interventions resulted in a 43-44% reduction (Cairncross et al, 2010). The major criticism to these results, as with much of the water-quality related health evidence, is that most results are based on *self-reported* diarrhoeal disease, which could be partly or wholly due to bias. Of the 35 trials reviewed by Cairncross et al (2010) only four were blinded, and these four had resulted in a low overall diarrhoeal reduction of only 7%. Thus, the authors concluded that 17% is more realistic diarrhoeal disease reduction for water-quality interventions. Other critiques of HWTS include its reliance on sustained uptake and correct and consistent use, which has not been satisfyingly proven in the literature (Cairncross and Schmidt, 2009). However, despite skepticism, there is strong evidence in the literature supporting positive health effects of HWTS with up to 60% reductions in diarrhoea (Clasen, 2009; Fewtrell et al., 2005). The

appropriate place for HWTS needs to be found, within the wider framework of water and sanitation interventions. Regional factors (e.g. water and culture), source water quality, local burden of disease (i.e. whether drinking water is the major cause of diarrhoea in a particular location) are examples of variables to be studied. Further work is also needed to support sustained and correct use of treatment technologies, including research on implementation models and technology performance evaluation.

### **1.5.2 Effectiveness of improved solid fuel stoves**

The assessment of stove effectiveness requires consideration not only whether the improved delivers on HAP reduction and other potential benefits such as fuel savings, but also whether it is acceptable to users, is maintained and remains in everyday use. It is useful to distinguish *efficacy* (what an intervention delivers in ideal circumstances) from *effectiveness* (what it does in realistic situations) and *efficiency* (whether it does so cost-effectively). These factors are considered in the overall report, but the focus in this section is on how effective the interventions are in practice in reducing levels of HAP in the home, and for personal exposures.

#### **Impact of interventions on household pollution and personal exposure**

On way to reduce emissions and hence HAP levels and personal exposure is to improve the completeness of combustion. In East Africa cheap improved stoves without flues, burning either wood (e.g. the Upesi) or charcoal, are popular and are reported to reduce kitchen pollution by improving combustion, although few (if any) measurements are available to support this. The current Kenyan study does include measurement of PM<sub>2.5</sub> (Section 3). Flueless wood stoves of the *Rocket* type, which use an 'elbow' combustion chamber to improve combustion, are being introduced in a number of African countries. These are claimed to deliver larger emission reductions, but formal evaluation is awaited and they are more expensive than the Upesi. The most encouraging new development in biomass combustion technology is the gasifier stove, which uses secondary combustion, with or without the aid of forced ventilation using a small fan. Various type of these stoves, which are rapidly gaining popularity in China and India, can burn either (finely chopped) 'raw' biomass, or processed (pelletized) biomass, and deliver emission levels of PM<sub>2.5</sub> close to those of LPG stoves (Kirk R Smith, personal communication). They are however quite expensive (US\$ 40-75), and there is to date very limited experience with use in very poor, rural communities.

The second approach to reducing emissions into the home is to attach a flue, or arrange a hood with a chimney. Improved stoves with flues have been promoted extensively in several Asian countries, although many have been found to be in poor condition after a few years. Some studies from India have shown variable and sometimes modest or minimal reductions in pollution. For example, *Laxmi* chimney stoves in homes located in Maharashtra, India resulted in a 24% reduction of PM<sub>2.5</sub> and a 39% reduction of CO, while a *sukhad* chimney stove in the Bundelkhand region of India reduced kitchen concentrations of PM<sub>2.5</sub> and CO by 44% and 70% respectively (Chengappa et al., 2007). Similar experience with flued stoves has been reported from Latin America. *Plancha* stoves in Guatemala (made of cement blocks, with a metal plate and flue) can reduce PM by 60 to 70%, and by as much as 90% when well maintained. Typical 24-hour PM levels (PM<sub>10</sub>, PM<sub>3.5</sub>, and PM<sub>2.5</sub> have been reported) with open fires of 1,000–2,000 µg/m<sup>3</sup> have been reduced to 300–500 µg/m<sup>3</sup>, and in some cases less than 100 µg/m<sup>3</sup>. (Alabalak et al., 2001).

HAP reductions studied in three provinces of China found 24-hr kitchen  $PM_4$  for all traditional stove types of  $268 \mu\text{g}/\text{m}^3$ , and  $152 \mu\text{g}/\text{m}^3$  for all improved stove types. Although a significant reduction, most homes were still above the Chinese national HAP air quality standard of  $150 \mu\text{g}/\text{m}^3$   $PM_{10}$  (Edwards et al., 2007). Evaluation was complicated by complexity of fuel types in regular use, changes within and between seasons, and multiple stove type use (improved and traditional) for various purposes.

Installation of hoods with flues for highly polluted Kenyan Masai homes resulted in reductions in 24-hour mean  $PM_{3.5}$  of 75% from more than  $4,300 \mu\text{g}/\text{m}^3$  to about  $1,000 \mu\text{g}/\text{m}^3$  (Bruce et al., 2002). Although a large proportionate reduction, the post-intervention levels were still very high, due to the continued use of traditional stoves, and the very enclosed, poorly ventilated traditional homes.

Where studied, personal exposure has been found to reduce proportionately less than area pollution. Thus, in the Kenyan Maasai study, a 75% reduction in 24-hour mean kitchen  $PM_{3.5}$  and CO was associated with a 35% reduction in women's mean 24-hour CO exposure. Similar proportionate reductions were found for women and children using wood stoves in Guatemala. A study of personal particulate exposure in Guatemalan children <15 months reported mean 10- to 12-hour  $PM_{2.5}$  levels of  $279 \mu\text{g}/\text{m}^3$  for open fires and  $170 \mu\text{g}/\text{m}^3$  for *plancha* stoves, a 40% difference (Naeher et al., 2000).

In summary, for improved solid fuel stoves to deliver very substantial reductions in levels of HAP, these need to have a well constructed, clean and functioning flue, or utilize secondary combustion to reduce emissions at source. Flues however add considerably to cost, and must be maintained and cleaned. Gasifier stoves are also relatively expensive for the populations concerned, usually need specially prepared or processed fuel, and experience in terms of suitability for poor rural populations requires further assessment. In order to ensure very substantial reductions in overall personal exposure, either clear fuels, or sustained use of low emission biomass stoves will be needed – although the latter is still the subject of ongoing evaluation.



## 2. COUNTRY REPORT – URBAN MAMBANDA, CAMEROON

### 2.1 Country background

The Republic of Cameroon has a population of 18.2 million people. Douala is the largest city in the country, and the commercial capital. Mambanda, where the project under evaluation was implemented, is a semi-formal settlement in the Bonaberi region of Douala. Mambanda reflects the diversity of the rest of the country, with Anglophone and Francophone households distributed across it, and great disparity between the few rich families and the poor majority.

Access to drinking-water is limited; being an island, Bonaberi groundwater is brackish and contains heavy iron deposits. Furthermore, the poor system of pipelines and management of treatment plants results in contaminated, poor-tasting and insufficient drinking-water. These local issues are also reflected in the health indicators for the country as a whole. Diarrhoeal disease accounts for 16.4% of under-5 mortality, and pneumonia for 20.4% (WHO, 2009). Additional statistics on water, sanitation, and household fuel for urban Cameroon are shown in Table 2.1.

**Table 2.1 Water, sanitation, and fuel use indicators - Cameroon urban areas (WHO/UNICEF, 2010)**

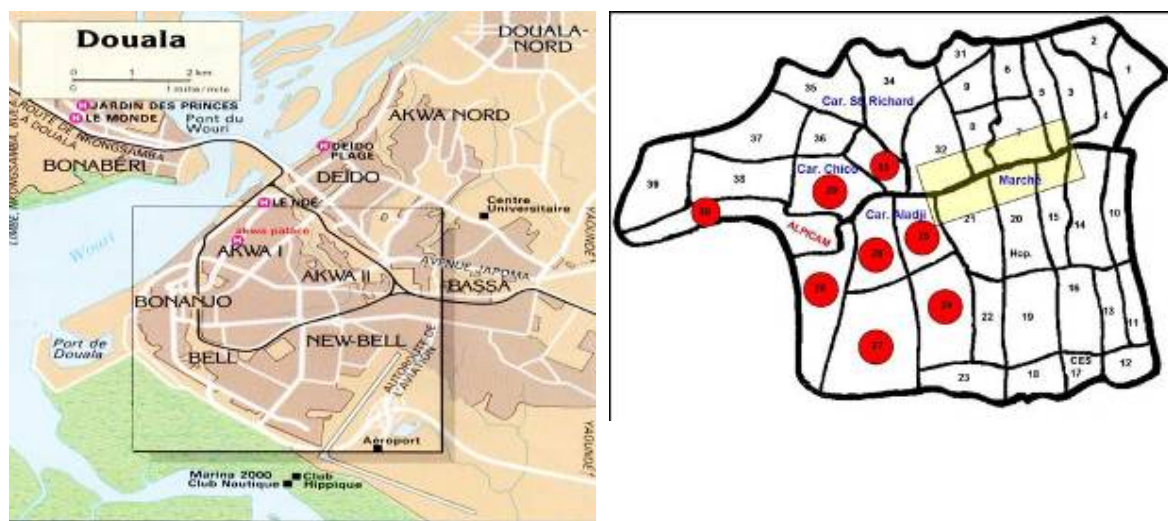
<b>Access to "improved" drinking-water sources</b>	Urban	92%
	Total	74%
<b>Access to "improved" sanitation</b>	Urban	56%
	Total	47%
<b>Main household fuel for cooking and heating % (WHO energy database)</b>	Dung	1.7 - 5.4%
	Crop wastes	< 1%
	Sawdust	Not reported separately
	Wood	47.9 - 67.1%
	Charcoal	2.4 - 4.6%
	Kerosene	8.8 - 13.5%
	Biogas	< 1%
	LPG	22.5 - 30.0%
Electricity	< 1%	

### 2.2 Project organization and management

A brief overview of the structure and management follows. Detailed assessments of project and financial management procedures were not part of the principal aims of this evaluation. Further information can be found in projects reports and with the individual participant organizations.

The German Technical Cooperation (GTZ) spearheaded the project, coined "Smoke & Drinking-water". It was set to run from June 2008 to November 2009, but due to administrative issues only began in late August 2008, running a total of 15 months. The project succeeded the two-year "Water and Sanitation" intervention (2006-2008), which was

the first endeavour by GTZ in Mambanda. Smoke & Drinking-water was put forward as the next phase of their activities. The two main technologies used in this project were an improved stove known as the Mambanda Multi Stove (MMS), and WaterGuard® (WG), a chlorine-based water disinfectant.



**LEFT** Map of Douala. Bonabéri, the island seen on the top left of the image is where Mambanda lies. **RIGHT** Map of Mambanda, with its local sub-divisions, labelled by GTZ. In red are the 8 intervention blocks.

**Figure 2.1 Map of Douala and Mambanda** (Extracted from GTZ, 2009)

Mambanda is divided into 20 blocks, with 8 of the poorer ones being chosen as beneficiaries of the Smoke & Drinking-water intervention (see figure 2.1). These blocks were comprised of a total of 1348 households, consisting of approximately 4,700 individuals (GTZ, 2009).

*Project structure and participants*

The major partner organization was the Association Camerounaise pour le Marketing Social (ACMS). The ACMS is a national branch of Population Services International (PSI), an international not-for-profit organization specialising in health social marketing. In Mambanda, the project involved local welders and local project implementers that consisted of four groups: community workers, health centre staff (involved in community mobilization), shopkeepers and specialized water vendors. All three groups sold WG. Community workers and water vendors also sold MMS stoves. Health centre staff supported community workers in mobilization and awareness-raising.

**Water provision**

The ACMS were charged with the provision of WG. They sold WG (and other products such as condoms and insecticide treated nets) at a wholesale price to the local distributors (shopkeepers, water vendors and community workers), who made a small commission from their sales. They also provided training on usage and best-practices. Their knowledge of social marketing extended beyond the distribution of WG to awareness-raising activities for the whole project.

Two small water treatment plants had been set up in Mambanda by GTZ during their first project, drawing and treating the low-quality groundwater. Water was partially treated, and pumped to six communal water pumps, which were managed by water vendors (local entrepreneurs). This water still required a degree of disinfection before drinking, and was sold at half the price of the nationally regulated water, along with WG and MMS stoves.

The community thus had the option of buying their water from 1) six locally- treated and -manned pumps, 2) water pumps drawing water treated by the national authorities and 3) nearby natural sources such as shallow wells and streams. Water from the six communal pumps (option 1) was sold at 25 CFA/litre as opposed to the 50 CFA/litre charged at nationally-controlled water pipes. People could buy this water along with WG sustaining both the GTZ-initiated water pump and the product. WG was sold to the community at 500 CFA/bottle. This price provided a 100 CFA profit to vendors and 25 CFA to a pooled fund managed by the local project committee.

### **Stoves**

Six local welding businesses opted to participate in the project, and were trained by GTZ for stove production and use. Community members could obtain stoves directly from the welders, at any of the six communal pumps or from the community workers.

The welders made a small profit from the sale of MMS stoves, though this item was more expensive, and needed to be heavily subsidized (as discussed further in section 2.4.2).

### **Implementation**

Community workers from Mambanda were used for mobilization and awareness-raising. They had been trained two years earlier by GTZ in the Water and Sanitation project, and were building upon their previous experience in this field, where they had made a name for themselves under the “Mami Pegna” logo (Figure 2.2 on the following page). They worked together with the health centre staff, ACMS, and project managers in awareness raising activities, and later into the project, where they sold both products.

### **Post-project proceedings: unplanned cessation of activities**

A series of events led to the project halting prematurely. It ended sequentially between August-November 2009. By August, existing WG stocks had reached their date of expiry, and ACMS’ WG suppliers would not renew their contract, resulting in no new stock. The cessation of supplying WG was largely due to faulty bottle-tops that would easily break, causing spills, and hastening the expiry of the product due to air exposure. The issue was noted by the national quality control body. Consequently, the only importers of WG halted their services to ACMS and beneficiaries began returning WG bottles in May 2009.

ACMS presence, and new WG stocks thus came to a halt by August 2009. The production of stoves continued, though by fewer welders. In addition, GTZ did not have additional funds to maintain their staff in the area, and for external reasons, moved their offices from Douala back to Yaoundé.

The exit strategy had been to train the local implementers, and maintain a local water and sanitation committee which would be integrated into the local government structure. The

Mayor of Mambanda was therefore incorporated into the project. However, it was reported that there had been friction between the community workers and the Mayor. According to the local project team this led to lack of follow-up after GTZ exited, unexplained staff replacement at the two water treatment plants (new staff had less training, leading to a reduction in use of the communal water pipes due to poorer water quality), cessation in communication with local project staff, and a freeze in the funds collected by the local water and sanitation committee (and subsequent dissolution of the committee). It is important, therefore, to note that the project had thus entirely ceased to operate by the time of this evaluation visit.

### 2.3 Education and product promotion

A portion of the project funding was used to assist promotional ventures including free WG distribution to early buyers of the MMS. However, as was seen in Kisumu, giving out regular free samples of a product one is trying to sell can often devalue it, and reduce the demand and attention given to NGOs operating in the area. Vendors were trained by the ACMS to understand the health benefits as well as the proper use of WG. Monthly follow ups were carried out by an ACMS field group, and periodic collective meetings with all the vendors. Promotional material was also made available at the vendors' shops. A decreasing subsidy system was established to monitor the effect of price on sales. There was a clear inverse relationship between cost and purchase. In terms of overall promotion, this was a positive step. As news of the MMS spread, some orders were placed from communities outside the project area.

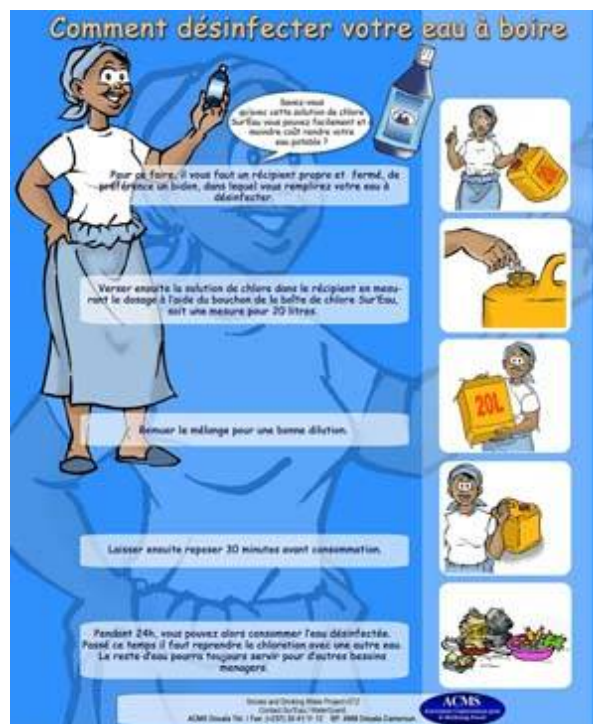


Figure 2.2 “Mami Pegna” poster (Extracted from GTZ, 2009)

Promotional events were held regularly at focal points such as churches, schools and community centres (particularly with women's committees). These were held by both the ACMS and local project implementers. Meetings were held in each of the intervention blocks, with joint demonstrations showcasing WG, MMS, and the fireless cooker (briefly mentioned in Section 2.4.2). These were accompanied by explanations of good practices, group activities led by ACMS, cooking demonstrations and public health education.

The community workers played a critical role in community mobilization and product uptake. Over the course of the first project, a trademark had been created, known as “Mami Pegna”. The community workers wore bright t-shirts showing a cartoon representation of “Mami Pegna” as illustrated in Figure 2.2 above. “Mami Pegna” is a woman symbolising good morals

and good practices – such as treating her water and cooking with an improved stove. The community workers were the first to use the products, which helped create a sense of familiarity and security with the product for prospective users. This brand effect, combined with the acceptance of the community workers, provided a powerful tool for promotion.

In April 2009, the community workers began selling WG and stoves themselves. Because they were familiar with the area, they could choose prominent households to be targeted first, and places to also hold communal product demonstrations. Their importance rose over the course of the project as they formed an important link between the community and the providers (ACMS, project managers, welders). There was widespread agreement that the project was only truly embedded in the community once the community workers began to sell the products. Unfortunately, stocks ran out by August, or after only three months since inception.

## 2.4 Intervention efficacy, effectiveness and efficiency

Most quantitative information in this section was obtained from the GTZ’s final report submitted to WHO after the field evaluation (GTZ, 2009). The GTZ report was divided into two separate sections: (1) Information from an assessment that ran the course of the project and (2) A small internal study conducted at the end of the project of 120 randomly selected households in the intervention blocks. The terms "final report" (1) and "internal evaluation"(2) will be used henceforth to describe these two sources of information. The report was written in French and therefore graphs extracted from the GTZ report for use in this document are in French, with English explanations. The “fireless cooker” (an insulated box used to complete the cooking of already heated and part-cooked food) was an additional element added after the project commenced and not part of the original project response to the WHO initiative and RFP (see Section 2.4.2 for a description). Thus the fireless cooker is mentioned only briefly here.

### 2.4.1 Household water treatment

#### *Prior Situation*

According to the project team, few people treated their water in Mambanda prior to the onset of the two GTZ projects (2006-2009). Cholera and other waterborne diseases were reported, and the only methods for treating water were homemade cloth filters and liquid bleach that was not specifically packaged or manufactured for water treatment purposes. Refer to Table 2.2 for an overview of household water treatment products in the area.

**Table 2.2** Products available and promoted in project area

Product (and active content)	Cost and volume of water treated/stored	Advantages	Disadvantages
WaterGuard® (Sodium Hypochlorite)	1 bottle sufficient to treat 1000 litres of water.  Sold at 500 CFA/bottle.	Inexpensive and good value for money. Easy to use, as bottle cap provides the measure for 20 litres.  Ready in 30 minutes.	Though the poor taste was noted when probed, most individuals did not mind the taste (unlike Kenya).  Reliance on technologies from abroad as opposed to locally produced methods.  It was also mentioned that the expiry date was too short, and that the bottle tops broke easily, further hastening expiry.

**(i) Efficacy**

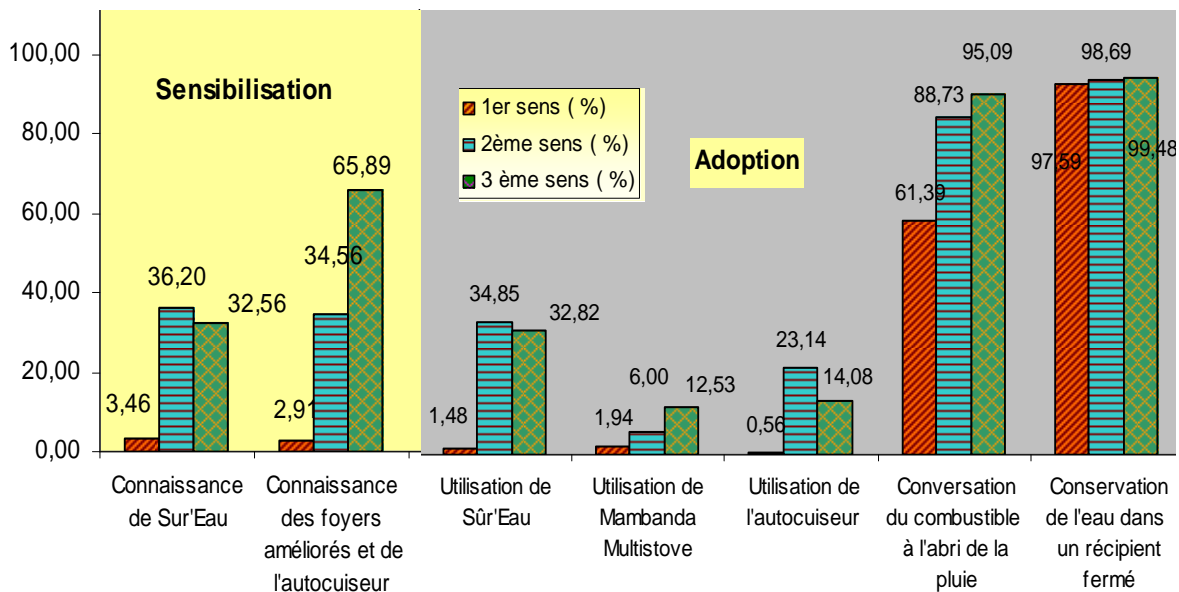
The efficacy of WG has been established in scientific literature, and will not be further discussed here (Latagne, 2007). However, the field efficacy issue discussed in Section 2.2 is important. The breakable WG bottle-tops hastened the expiry of the product leading to the only importers of WG halting their services to ACMS. (In February 2010, WHO was informed that ACMS was looking for new partners to obtain fresh supplies). The subsequent return of bottles affected the data by reducing the available time to test the effect of the joint interventions, and also influencing the intervention population’s view of the product and health impacts.

**(ii) Effectiveness**

Effectiveness depends on how the products are used in practice, for which 'user compliance' is critical. Below is a summary of key compliance information, obtained from the GTZ final report and internal evaluation.

*Awareness and adoption*

As demonstrated in Figure 2.3 on the following page, awareness of WG grew from approximately 3% to 35% of intervention households, and actual usage increased from



approximately 1% to 34% of households over the course of the project. Furthermore, according to GTZ approximately 90% of product awareness was created through the project, suggesting the awareness campaign had a considerable effect.

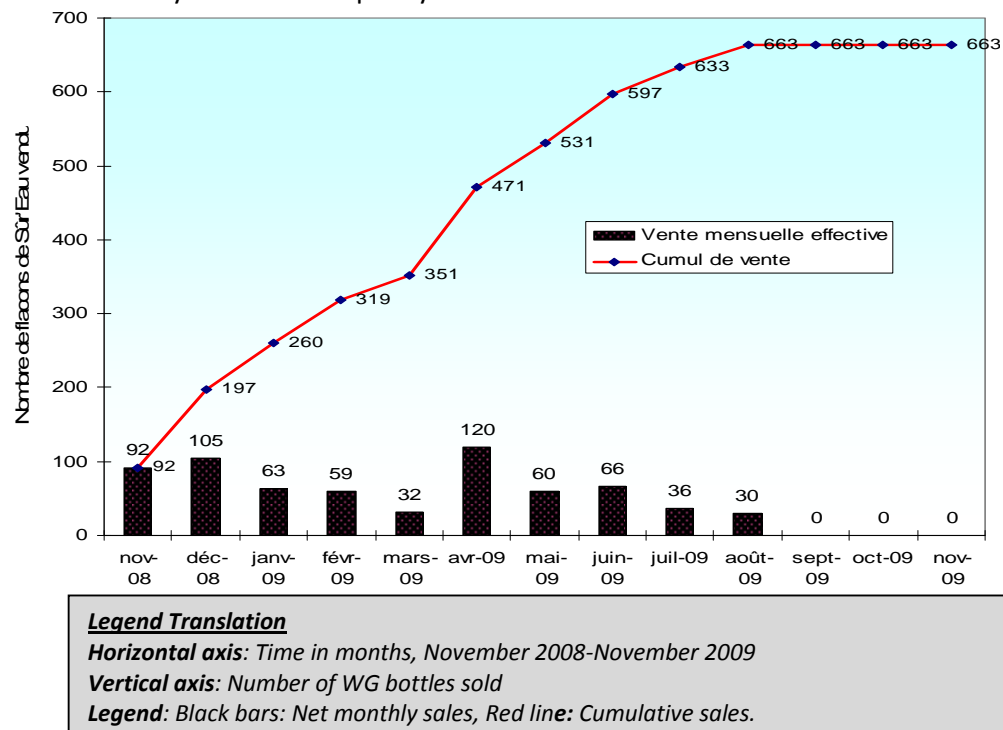
**Legend Translation**  
**Horizontal axis:** (Yellow box- Sensitisation): Awareness of WG; Awareness of MMS and fireless cooker; (Gray box- Adoption): Reported usage of WG; Reported usage of MMS; Reported usage of fireless cooker; Good practices of wood storage; Good practices of household water storage.  
**Vertical axis:** proportion of respondents (%).  
**Legend:** 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> phases of assessment (as explained at the beginning of Section 2.4)

**Figure 2.3** Awareness and adoption figures for WaterGuard, fireless cooker and MMS (Extracted from GTZ, 2009)

The reported figure of 35-40% still falls considerably short of the target uptake proportion of 90%. While it may be that the target was over-ambitious, the uptake is still relatively low. Other noteworthy results in the final report (though not graphically displayed) include the reported 68% of households having heard about WG through “Mami Pegna”, highlighting the importance of community workers in product promotion. Regarding safe storage of water (in a covered receptacle), practice seems to have been high, where above 95% were reporting doing so even before the project was implemented. It is to be noted that no testing of chlorine residuals was conducted over the course of this project, and thus all figures of compliance are self-reported.

### Sales

November and December 2008 saw the initiation of the project and first promotional period. At the start, relatively high sales were observed as seen in Figure 2.4 which shows sales of WG from November 2008 – August 2009. It is important to note that this data represents ACMS sales to project implementers, and *not* beneficiary uptake. The drop between January-April 2009 suggested less success with the promotion efforts, and lack of awareness and enthusiasm for the product in Mambanda. April 2009, however, was an important month, as it was when the community workers (“Mami Pegna”) became personally involved in sales of WG and MMS (until then it was only vendors). This time period represents the highest sales in any one month. The project team, and interviewed households affirmed that the inclusion of community workers in sales greatly affected demand and uptake. The general decline from May 2009 through to August 2009 illustrates the various issues that had started to affect the project (see Section 2.2). This included product expiry following breakage of bottle-tops leading to a reduction in sales and the halt in WG importation due to subsequent restrictions by the national quality control board.



**Figure 2.4** Monthly sales of WG over the course of the project (Nov 08 – Aug 09) (Extracted from GTZ, 2009)

It is likely that the results would have been considerably different if the issues with WG had not taken place. The field visit revealed that despite these issues, an increased demand for new supplies of WG indicate at the project had an impact on the intervention communities. This is supported by the internal evaluation, where approximately 82% of households expressed doubt over the quality of drinking-water at source (whereas interviews suggested this was significantly different prior to the project). Evaluation interviews noted a shift in people's attitudes thanks to the awareness raising activities, leading to a greater understanding of health, hygiene and a subsequent demand for cleaner water. Eighty-eight percent of households in the internal evaluation also believed that water quality affected their family's health and 30% reported having less diarrhoeal episodes since using WG.

### ***(iii) Efficiency***

No formal attempts have been made to carry out an economic evaluation of the water treatment interventions. However, in the internal evaluation, 64% of respondents expressed that using WG allowed them to always save money, with another 11% reporting that WG use provided cost savings periodically. **The left portion of Figure 2.5 displays** the water treatment pump set up by GTZ during the earlier Water & Sanitation project. This had partially treated groundwater, which was distributed to the communal water pumps as shown on the right-hand side photo. The water vendors would sell water at half the price of the national water pumps set up by the government. The water was sold alongside WG (as can be seen from the WG poster on the door). Vendors were also supplied with MMS stoves, as well as other items from the ACMS including ITN nets and antibacterial soap.



**Figure 2.5** Communal water pump and local water treatment plant (Photo credit: Shaheed A, 2009)



## 2.4.2 Improved stoves: reduction of household solid fuel air pollution

### *Prior situation*

Traditionally, three-stone-stoves were the most commonly used in Douala. These consisted of three stones surrounding a fuel source, typically wood or sawdust. Although inexpensive, the stoves caused substantial air pollution and consume fuel inefficiently. In the rainy season, people usually have to cook indoors, or in covered areas by their house, exacerbating exposure. Sawdust and firewood would also increase in humidity at these times, releasing more smoke. The rainy season also causes increased charcoal use, which is more expensive, and requires a different stove. Gas stoves were used by some residents (often slightly wealthier). While these gave off no smoke, they were the most expensive, and the designs used by most in Douala presented considerable dangers of burning. A summary of the advantages and disadvantages of the various stoves is provided in Table 2.3 on the following page.

**Table 2.3** Advantages/disadvantages of products available and promoted in project area

Product	Cost		Advantages	Disadvantages
	Stove	Installation		
<p><b>Mambanda Multi Stove (MMS)</b></p> <p><b>Description:</b> multi-purpose, portable stove, capable of using wood, sawdust, and charcoal as fuel.</p>	<p>Introduced by GTZ in 2009</p> <p>Real cost to cover all expenses and provide profit of 10,500 CFA/unit.</p> <p>A decreasing subsidy, selling stoves at 6,500 (14 USD) projected to increase up to 9000 CFA by November 09 (not in practice).</p>	<p>Portable, normally kept indoors in rainy reason, and outside in dry periods.</p>	<p>No installation required and simple to use.</p> <p>Innovative design, allowing several fuels to be used (coal, wood, sawdust), and apparently burning fuel more efficiently.</p> <p>Apparently able to cook food faster due to better heat concentration. From observation, smoke greatly reduced, causing less eye irritation and coughing.</p> <p>Attractive.</p>	<p>Cost was the principle issue.</p> <p>Welders could not sell any cheaper because of high production costs.</p> <p>Over the 6,500-9,000 CFA price range, major drops in sales were seen by 7,500 CFA.</p>

<p><b>Fireless cooker</b></p> <p><b>Description:</b> Insulator, cooking food over a longer period of time by retaining heat and steam.</p> <p>One brings the food to cooking point before with fuel, and then transfers dish to the fireless cooker.</p>	<p>Zero cost (can be built with natural materials at home).</p> <p>Requires initial heat source to commence cooking.</p>	<p>Portable, no installation required.</p>	<p>No installation required. Allowed women to be more mobile, as they could leave their food cooking.</p> <p>It kept food warm.</p> <p>Affordability, and innovative nature made it attractive.</p>	<p>Only for dishes that can be slow-cooked (e.g. rice, stews).</p> <p>Does not avoid the need for fuel, but reduced the amount required overall.</p> <p>Requires over twice the normal cooking time.</p>
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### *Mambanda MultiStove*

The MMS was designed by GTZ-Cameroon. It was a composite of different improved stove models, such as the Burkina Mixte Stove, the Black Power Stove and the Improved Mbaula. The main fuels it is designed for are wood, charcoal and sawdust. The stove is supposed to greatly reduce the amount of smoke produced, direct heat more effectively for cooking and burn fuel more efficiently. Please see Figure 2.7 for information on efficacy. See Table 2.3 below for more information on the products. **The upper photo displays** the finished products on display by a local welding shop while the lower photos display the first two steps in construction. The main raw materials are bricks, iron, and cement.



**Figure 2.6** Mambanda MultiStove production (MMS) (Source: <http://www.hedon.info/StoveImages>)

### **Effectiveness**

*Awareness, adoption*

Figure 2.4 demonstrates the final report's data on awareness and uptake. It noted an increase from 3% to 66% of households being aware of the MMS and fireless cooker over the course of the project. Actual uptake, however, rose from 2%-13% for the MMS. The difference between awareness and actual uptake of MMS reflects, largely the effect of price. In contrast, awareness and uptake figures of WG were nearly identical. The discrepancy in the data for MMS shows that only a few people are able and/or willing to purchase it amongst the target population. Only 220 of a total of 622 stoves were sold in Mambanda. The rest were sold outside the target area. There was insufficient data to appropriately qualify uptake of MMS on the households that bought the stove. However, its popularity was clearly noticed during our field visit.

#### *Price issues*

Our interviews suggested that many Mambanda sales were to richer families from the neighbourhood and during sales at promotional venues. Most successful sales were said to be at church promotions, where wealthier people (often owning cars) were happy to purchase them, for the technological merits of the product. A local welder said that at least 30% of his sales were for wealthier people outside of Mambanda, and that some were bought as gifts to be sent outside of Douala.

It was hoped that the price could eventually be raised to about 9,000 CFA (from the initial 6,500 CFA), but it had to be capped at 7,500 CFA, which already represented a significant drop in sales. Indeed, only three of the six local welding businesses continued production after the end of the project (and subsidy).

Some MMS users would use it sparingly in order to reduce wear and tear. The cost (or perceived upfront cost) of fixing it meant that once damaged, a stove could be left behind, and replaced with a three stone stove. Many would cook outdoors when possible, and use the MMS when cooking indoors, such as during periods of rain. During rainy periods was also when welders noted a rise in sales.

#### *Health effects*

All data available on this topic are self-reported. The internal evaluation showed that 86% of households considered smoke to be an issue, with 76% considering it to specifically affect health. The president of the health committee stated that he had seen a reduction in eye irritation, conjunctivitis and pulmonary disease such as bronchitis in homes using MMS stoves. Visible smoke reduction was also apparent during our field visit.

A community worker recounted a discussion with a householder who initially stated "I was born in smoke. I will die in smoke. It is something we live with, and is not a problem". The same person, after using MMS, stated he could no longer "imagine life living in smoke".

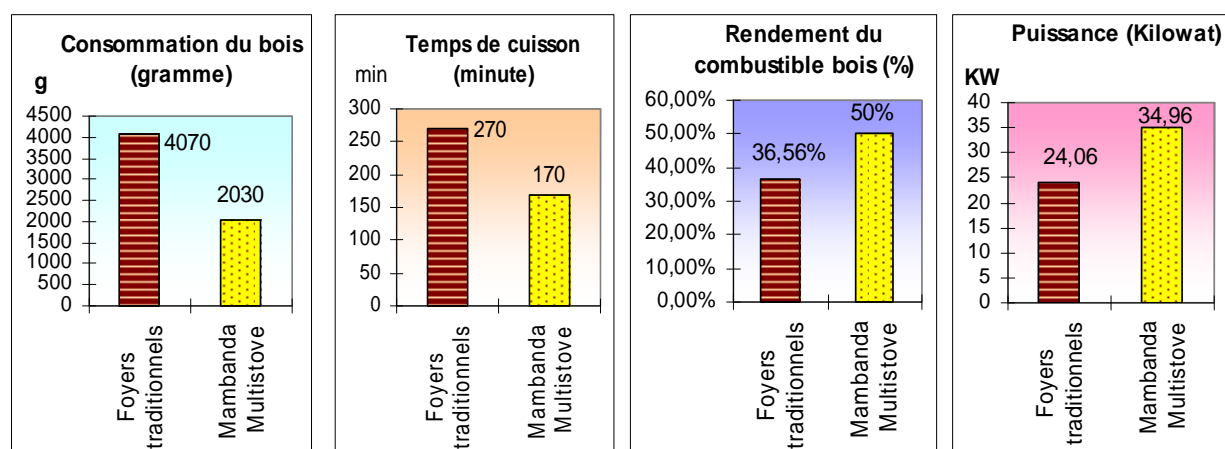
#### *Other effects*

In the evaluation interviews, MMS users all seemed pleased with the product, for the reduced fuel consumption and an improved cooking experience. They were impressed with the innovative nature, allowing better heat transfer, combustion, and particularly, the use of firewood, sawdust and coal. Over 95% of MMS users in the internal evaluation said that it saved them money and had changed their way of cooking. Even households that did not own

an MMS would readily discuss its benefits. It was a source of pride, something people would save up for and offer as gifts.

### **Efficacy**

Whereas no published reports or peer-reviewed scientific papers were, to our knowledge, available on the MMS (being unique to Mambanda), tests were conducted by GTZ on efficacy (Figure 2.7) in comparison with the traditional stoves. According to these tests, MMS releases an additional 10 kW of power, consumes half the amount of firewood and even cooks a meal of beans in half the time as a three-stone stove. Tests also revealed 50% fuel efficiency using MMS, as compared to 37% with a three-stone stove. In contrast to the testing done in Kenya, in Cameroon tests on emissions of or indoor levels of particulate matter were not conducted.



#### **Legend Translation**

(from left to right)

Traditional stoves (left), and MMS (right)

**Table 1:** Wood consumption (grams). The comparison is between traditional 3 stone stoves (on the left) and the MMS (right)

**Table 2:** Cooking time (minutes). Same comparison as Table 1, between traditional stoves (right) and MMS(left).

**Table 3:** Combustion efficiency of wood (%). Traditional stoves (left), and MMS (right)

**Figure 2.7** MMS vs. traditional stone stoves; tests on fuel consumption, cooking time, combustion, and energy (Extracted from GTZ, 2009)

### **2.5 Finance and loan arrangements**

No finance or loan arrangements were made in this project, though microfinance and regular banks existed in the area. The project managers mentioned a general reticence among the poor in Douala to use such services. Reasons included the belief that microfinance banks were corrupt, a large principal was needed before being able to take a loan and the fear of financial/legal reprisals if loans were not repaid. No evidence was found for these beliefs though, and consultation was not held with a representative of any bank/credit scheme.

### **2.6 Added value of integrated delivery: synergies**

We used the framework derived from the background paper by Clasen and Biran (2009) to assess the advantages and disadvantages that were reported to us and which we observed. These are presented in Table 2.4.

**Table 2.4** Overview of project synergies and antagonisms

#	Area of potential synergy or antagonism	Synergy (Benefit)	Antagonism (Shortcoming)
1	Government policy integration: <ul style="list-style-type: none"> <li>National</li> <li>Local (city, province)</li> </ul>	N/A (no such integration as yet).	Interviews with project staff and beneficiaries indicated some apprehension for working with the government.
2	Situation analysis (e.g. baseline survey)	GTZ and ACMS noted reduced costs. Households were also glad to be asked baseline questions only once.	More time spent in baseline survey as more to cover.
3	Combined supply and distribution outlets	Project team all found this beneficial. It was easier to supply water vendors with both products, simplifying accessibility for the beneficiaries.	Coordination presented difficulties between ACMS and GTZ, being two large organizations with different schedules.
4	Combined business opportunities	Vendors selling more products, and welders able to link with water treatment outlets and promotional events.	This requires more coordination efforts.
5	Potential health benefits from combination: <ul style="list-style-type: none"> <li>Reduced HAP from less need to boil water</li> <li>More water available for hand washing</li> <li>Other (specify)</li> </ul>	Message better received when combined.  Beneficiaries made connection between both interventions and their health.  Possible greater health benefits from this, though no quantitative data exists.	Less time spent on each intervention by project informants.
6	Combined educational initiatives: <ul style="list-style-type: none"> <li>Actual content</li> <li>How delivered</li> </ul>	Efficiency. Using same communication channels saves money for organizers and gives combined message.	Sometimes splitting costs of education and promotion was difficult between ACMS and GTZ.
7	Combined promotional messages: <ul style="list-style-type: none"> <li>Researching approach</li> <li>Individual sensitization</li> <li>Community sensitization &amp; mobilization</li> <li>Other</li> </ul>	E.g. “Mami Pegna” posters used for both messages.  Individuals who already used one product may have been more receptive to the other by association.	
8	Finance: <ul style="list-style-type: none"> <li>Support (subsidy, loans)</li> <li>Competition for limited household resources</li> <li>Other (specify)</li> </ul>	Subsidies for MMS helped increase sales.	Splitting costs of education and promotion could be difficult between ACMS and GTZ. Sustainability of subsidy funds was an issue.
9	Opportunities for integrating additional activities/products <ul style="list-style-type: none"> <li>Follow-up activities</li> <li>Training</li> <li>Specifically health-related</li> </ul>	Only one report, final assessments or evaluation to be written.  One set of community workers needs to be trained.  Less focal points for more	Coordination of compiling and disseminating results needed.  Training takes longer

#	Area of potential synergy or antagonism	Synergy (Benefit)	Antagonism (Shortcoming)
		<p>information.</p> <p>Easier for trust and acceptance of project implementers &amp; community workers.</p> <p>ACMS could promote other public health supplies via the local implementers, including ITN nets, condoms and soap.</p>	

Overall, this assessment found that the integrated delivery of products for improving the household environment was positive.

The key advantages were:

- Efficiency for users (greater accessibility to health products, and less time, meetings, community workers and ‘hassle’)
- Efficiency for staff (combined promotion, delivery points, activities, reporting and assessment)
- Promoting health in a more holistic fashion, drawing linkages between different interventions.

The main challenges noted were coordination and management, which require further development when working with joint interventions. It was also mentioned by the ACMS that they could spend less time on any one technology given that they had more to go through in a particular event. This issue was not mentioned by beneficiaries, however.

## 2.7 Recommended areas for further research

### Technology

- lab-based efficacy trials of stoves (including small particle monitoring)
- optimization of stoves (more cost effective construction, fuel efficient designs)
- market research on different HWT technologies and business strategies for promoting and sustaining product sales

### Uptake

- measuring financial gains for implementers and beneficiaries (e.g. cost reduction from streamlined campaigns, days of field work, boosts in sales, saved fuel, etc)
- analysis of factors for demand/uptake. Assessing reasons for purchasing/not purchasing one or more products. This could include willingness-to-pay, socioeconomic indicators, exposure to behaviour-change activities, technological benefits, health benefits, etc.

### Exposure and health

- measurement of household air pollution and exposure with stoves in everyday use

- microbiological and chemical quality of treated water in intervention households, including stored water and the effect of safe storage (e.g. testing for chlorine residuals)
- measurements of hygiene practices, and sanitation would be valuable in the context of measuring waterborne disease and health-related behaviour change
- if feasible (and subject to resources), when uptake and effectiveness of interventions (in particular the stove intervention impacts on air pollution have been demonstrated and shown to be effective), carry out health outcome assessments.

## 2.8 Scaling-up

The following are recommendations made by the project team and beneficiaries, aimed at widening joint IAQ and HWTS interventions.

### 2.8.1 Local level

This section focuses on extending the project to all of Mambanda. As these are all household-level interventions, these recommendations may also be considered when planning at national level.

#### 1. Local ownership and involvement: water & sanitation committee

Establishing a new Mambanda water and sanitation committee, which would have:

- ownership by the community and project stakeholders
- a sound financial system in place to keep it self-sufficient and sustainable
- local government involvement; heads of neighbourhoods and districts would be involved as partners in the collaborative community work of the project
- a well-trained and incentivized group of community workers

The “Mami Pegna” initiative created a two-way link between beneficiaries and organizers. Referring to their improved practices in water treatment and hygiene, one person noted, “Mami Pegna taught us so many good things”. Though the group was disbanded at the end of the project (see Section 2.2) there was overwhelming support by the project team and community to bring them back. Figure 2.8 displays the Mama Pegna workers on the left making rounds of an intervention block and on the right meeting with the two project managers (in red).



**Figure 2.8** “Mami Pegna” community workers (Photo credit: Shaheed A, 2009)

2. Shared promotion

This point was particularly emphasised by the welders, who saw a benefit to sales through sharing promotional resources with the WG promoters. In such joint interventions, sharing promotional space also allows several aspects to be covered in limited space, and spread awareness.

3. Transport

Transport affects availability and access. It is necessary, particularly for heavy stoves like the MMS to obtain adequate transport within and outside of Mambanda. The same point was raised in the Kenya evaluation.

4. Sanitation and well-chlorination

This was the core work of the Water and Sanitation project, and was very popular. It halted due to lack of funds. It was felt that the effects of this project were important, and should be continued alongside household interventions.

5. Education

Education of vendors and welders was limited by time and resources. Training of “soft skills” is essential to inducing behaviour change. The community workers, who were the most educated in health promotion and the products, found the community, including other vendors and welders, insufficiently informed.

6. Local health centres

The president of the Mambanda health committee noted that local health care providers should be more involved, and used to promote good practices and household treatment options as well as smoke-reducing stoves.

**2.8.2 Larger scale (city – national)**

1. Widening product choice (*\*important for both local and wider implementation*)

In addition to the issues experienced with WG in Cameroon, increasing variety has been demonstrated to boost overall sales. This would also further benefit the vendors and could add new partners and funding to the project.



2. Link to wider economic development programs  
Integration needn't be limited to health interventions. Economic development may lead to a higher uptake of products. This includes collaboration with the private sector, which may be looking to associate with such development initiatives (to raise their public profile, for example).
3. Integration with climate change initiatives  
Climate change is an important, high profile issue. Given its links to household energy and environmental health, it could be a valuable area to form connections with, particularly as more efficient stoves can reduce emissions of global warming pollutants (and this may offer financing opportunities).
4. Support from international agencies  
GTZ expressed the view that obtaining official support (e.g. written) from international organizations could lend credibility to local level implementers and entrepreneurs (e.g. welders), increase funding and local/national support.
5. Resources  
All of the paths suggested above require further funding and human resources. Funding options would be one of the first points-of-action required in an attempt to scale-up.

## **2.9 Discussion and conclusions**

### **2.9.1 Conclusions**

Dissociating the *project* from the *issue of integration* was a complex matter in this case. This was partly due to the circumstances that led to the project's abrupt termination, and to the fact that this intervention represented the bulk of the project in Mambanda. It was thus difficult to differentiate between factors affecting project termination and those that specifically affected the adoption of the two integrated interventions.

#### *Synergies*

Integrating household health interventions demonstrated clear advantages in Mambanda. From a programmatic point-of-view, such a project saved overcrowding of field sites, and created efficiency in terms of data-collection, promotion, and human resources. From the beneficiaries' point-of-view, it created efficiency in terms of time spent in meetings/awareness-raising events, a consolidated, holistic view of their health, and potentially greater uptake. Our interviews and questionnaires did not report any views against the combined implementation of the two projects.

On the other hand, such interventions also require an excellent organizational structure and management, as logistics become more complex. Monitoring of such programs needs to be equally well-organized. When attempting to understand synergies, we found that an analysis of motivational factors may be important. The major motivation to buy a stove seems to have been its innovative nature and perceived benefits such as a cleaner cooking environment, reduced visible smoke, and fuel efficiency. Health benefits were less

perceptible, and as noted, have yet to be proven. The primary motivation for clean drinking-water was health – which was largely thanks to the awareness building activities of the community workers. They would treat it, in faith that it would benefit their health. The single banner used in promotion was “the kitchen” (and thus Mami Pegna). Two interventions with two different primary motivations joined under a single banner. Recognizing motivational factors, and finding effective promotional messages/banners thus seemed to be a pertinent consideration.

While integrating certain approaches may prove to be beneficial, the details involved in such an approach should also be made clear. The limits, modes, and interactions of different models of integration must be analysed. Important questions in the context of this project include: What other interventions could or should be joined? What are the most effective banners under which to link the interventions? What should not be added to integrated household interventions? At what level will it have the greatest effect?

Finally, the effect of integrating new public health initiatives to pre-existing ones is also noteworthy. Much of the status, and importance given to the Smoke & Drinking-water project rode on the earlier Water & Sanitation initiative. Many communities in the world are recipients of the continuous influx of new (and often short-lived) development projects. Continuity and integration are related in that they both engender a more holistic understanding of public health activities, and may potentially help specific messages take deeper root.

#### *Community ownership and participation*

The “Mami Pegna” community workers were found to be an essential component to behaviour-change, imparting education, and putting the theory of joining interventions into practice. “They also represented the interface between beneficiaries and organizers, giving the community access to knowledge, people and organizations that could positively affect their lives. They also gave the project team a better understanding of community needs and opinion. As local promoters, they contextualized the products. They also felt under-appreciated (financially and within the context of the project), and through the termination of the project, their added value was lost.

#### *Government involvement*

How to scale-up at the government level remains an important question. Finding ways for multi-stakeholder, community-level projects to liaise with the government, but not be entirely reliant on it are important for such interventions. Building a good governance system using the multi-stakeholder approach, including the community-level component could be promising.

#### *Finances*

A sustainable business model is of utmost importance to the viability of such a project. Models need to allow community-ownership, a mutually beneficial relationship with the government, and a pricing-system that is viable for providers as well as end-users. It is recognized that subsidies for MMS were made from the project funding. Thus, methods of changing the price of the product or finding alternative (and hopefully more sustainable) funding for subsidies are required.

Linkages to wider economic development programs, as mentioned in Section 2.8.2 could also be made. The success of such interventions rests on people's willingness and ability to pay them, and thus a sustainable market (with or without supportive financial instruments), is essential.

#### *Health impact*

The data on health benefits are inconclusive, mainly due to lack of information on validated compliance with water treatment and IAP exposure changes. Furthermore, both water treatment and household energy interventions have had mixed success, and debate continues about the extent and nature of their health effects in practice. Some of the recommendations in 2.7 include suggestions for improved data collection.

As far as we could note, the beneficiaries appeared to be interested and actively participating, and also seemed more aware of consequences for their health as a result of the GTZ efforts since 2006. This was also seen in the GTZ final report as reported in Section 2.4. We noted a clear demand for clean drinking-water in the intervention blocks visited, and neighbouring residents were also vocal about wanting their blocks to be included in the study.

It must also be noted that the benefits from water-treatment projects in low-income settings also rest on other barriers of transmission of water-related disease (Cairncross, et al., 2010). As such, hygiene and sanitation are essential components of any approach aiming at these diseases. Similarly, safe water storage could have been a more important component in monitoring this project. Safe storage is an essential part of HWTS, as any recontamination from poor household water management practices could nullify the effects of treatment.

#### *Mambanda MultiStove*

The product demonstrated potential for scaling up. Though health was included in its promotion, its success seems to have stemmed from the technological and aesthetic improvements, compared to traditional cooking methods, that it provided. Its popularity as a fuel-saving stove that was also able to use a greater range of fuel extended its popularity beyond Mambanda, and in some cases even Douala.

To date, there has been no research on reductions in emissions, exposure or health effects. However, a degree of reduced visible smoke was noted (as in Kenya, section 3), and the MMS was built on several designs of improved stove, which have been shown to reduce emissions.

Though interest was high, cost was a major barrier to uptake. Microfinance could be a possible way of addressing this issue, but was not pursued. What was pursued was the formation of a financing committee, using the local project team, which could be self-sustaining after an initial start-up fund. As discussed above, funding solutions are vital.

#### *HWTS*

The evaluation noted a clear demand for safe, clean water. Beneficiaries noted how their community's attitudes to water, health and hygiene had positively changed since the GTZ's projects in Mambanda. Earlier we mentioned how the demand for clean water seemed to

have different motivational factors than for stoves. The benefits of clean water (other than taste) are less perceptible – particularly in the short term – and thus require a deeper understanding of the reasons to do so. The project team, and brief discussions held with other intervention blocks all wanted to expand the project to the rest of Mambanda. They also wanted to introduce different HWT products, in order to broaden the choice of products and also in light of the complications experienced with WG. The awareness-raising campaign (including community workers) played a critical role in this aspect to the project, and showed how interest in clean water provides benefits above and beyond the particular product.

As with the MMS, there was little research-based evidence available from field evaluation to demonstrate beneficial health effects from the project. However, health effects, to a degree, are established in the wider literature on HWTS (outlined in Section 1.5.1), based on self-reported data on uptake, use and water storage. There was little information on the type of usage of WG (how correct and consistent it was), and calculations of adoption also needed refinement, as seen in Section 2.9.2.

The fact that issues with stock can affect a water treatment project so drastically raises questions about the sustainability of buying products that are not easily available locally, and whether simpler and/or locally available products would be a better choice.

### 2.9.2 Data

Table 21 provides a summary of methodological aspects to consider when viewing the data. We also discuss certain additional areas that could have been explored to obtain more information from the target population. It must be noted that many of these issues were due to the extenuating circumstances of the project, and related pressures, as discussed in section 2.2.

#### *Sampling*

The results of the final report, as seen in Section 2.5, were obtained from two processes. The first one, called “final report” in this evaluation was data collated from three “phases” of the project. Table 2.5 shows the sample sizes and collection periods for this.

**Table 2.5** Phases of data collection for the GTZ final report

Phases	Dates of phase	Number of households investigated
1	November 2008-January 2009	1080
2	February 2009 – March 2009	1145
3	June 2009 – August 2009	1300

#### *Methodological aspects:*

- The number of households changed between Phases 1 and 2, and again to Phase 3. It was unclear why the denominator increased, and what the total number of households in the intervention blocks was (the total number of households discussed in the final report was 1348).
- It was also unclear how the data was collected over this time, or how data were managed and analysed.

The second investigation that informed the report, termed “internal evaluation” in this document was a final investigation conducted in November 2009 of 120 households. The method of sampling was to take one house ‘randomly’ (method not specified) per intervention block, and then to elect every 10<sup>th</sup> home along that street.

#### *Uptake/adoption*

There were some limitations in the methods for reporting the uptake of MMS stoves. Measures of sales could have been qualified, for example by breaking these down into sales made by ACMS (to the project team), and the local implementation committee (to the beneficiaries). April was the period with the highest sales, as seen in Figure 2.4, followed by a steady decrease from May 2009 – which was largely due to the issues with WG stock and expired bottles being returned.

The assessment of adoption could have benefited from more detail. Explanations of data collection methods, whether adoption was self-reported, and how data was verified/cross-checked would have been useful. Adoption measurements for WG could have specified frequency of use, last usage dates, etc. Frequency of MMS usage (e.g. per week) would also have been valuable in assessing the likely impact on indoor air pollution levels.

It was not clear how safe storage was monitored, other than verification for the presence of sealed water containers. Tests of water quality and more detailed information on storage practices would have helped in assessing likely health impacts, and should be considered in future studies.

### **2.9.3 Final comments**

In conclusion, we found the project in Douala to have developed and implemented a number of valuable practices, and provide valuable experience for future work on integrating household level environmental health interventions. It showed the effective use of community workers and promotional methods, which may be used as examples for both single and joint interventions. It saw active community members engaged in a multi-stakeholder committee, showing successful use of representative governance models. Water treatment and improved stoves can be effectively packaged together. Unfortunately, there were important issues with supply, and the financial sustainability of the project. Because the MMS product was unaffordable, the short term project funds were used to achieve sales. The entire viability of the project rests on its ability to generate income for all involved, and must thus be re-assessed. We can say that the reported issues were thus more circumstantial, and do not impact the positive aspects of integrated projects as such. Based on the work in Mambanda, integrated implementation seems to be an area with considerable potential, and worthy of further investigation.

Finally, the evaluation of adoption and compliance with the interventions would have benefitted greatly from more detailed and systematic study, including actual measurement of, for example, chlorine residuals and indoor air pollution. Whilst we recognise that this would have required deployment of additional resources, the importance of this information is such that it should be built into proposals and plans for project funding and implementation.

### 3. COUNTRY REPORT – RURAL NYANZA, KENYA

#### 3.1 Country background

Kenya has a population of 38.8 million, 68% of whom live in rural areas (WHO/UNICEF, 2010). Key child health indicators (Table 3.1; Annex 4) show that infant and child mortality are high, and that diarrhoea, pneumonia, malaria remain priority conditions for child survival. Diarrhoea and pneumonia alone account for over one third of all deaths under 5 years, and malaria an additional 14%. These three diseases are of primary concern for this project, dealing as it does with products for safe water, reduced indoor air pollution, and also the promotion of insecticide treated bed nets (ITNs). Among diarrhoeal illness, there is also considerable concern about the continuing problem of cholera.



**Figure 3.1** Children in Nyanza  
(Photo credit: Bruce N, 2009)

**Table 3.1** Child health indicators - Kenya (Extracted from WHO, 2004)

Indicator	Year	Indicator value
Infant mortality/1000 live births	2006	79
Under-5 mortality/100 live births	2006	121
Pneumonia (% of child deaths under 5 years)	2000	19.9%
Diarrhoea (% of child deaths under 5 years)	2000	16.5%
Malaria	2000	13.6%

#### *Water and sanitation*



**Figure 3.2** The most common sources of water for the residents of Nyando district, Nyanza, are rivers, bore holes (which are not deep), ponds, and rain water. Flooding is very common, which leads to faecal contamination of all of these sources (Photo Credit: Bruce N, 2009).

Figure 3.2 illustrates some of the common household water sources in rural western Kenya. Data from the JMP indicates that access to improved water in *rural* Kenya (2008) is 52%, an

increase from 43% in 2000 and 25% in 1985. Household connections, however, remain very low at around 10% with little change over the same period. Improved water does not guarantee that water is reliably treated and safe to drink. The proportion of rural Kenyans with access to improved sanitation, although not the focus of this project or report, is low (32%) and rises slightly if shared latrines are considered (50%). However, these figures have increased only slightly since 1985.

### *Household energy*



Data from the WHO household energy database (2010), show that in **rural** Kenya, 95.6% of the population used biomass as their primary cooking fuel, 85.2% of which was wood and 10.2% charcoal (Figure 3.3).

**Figure 3.3** A 3-stone wood fire, the most common type cook stove and household fuel in rural East Africa. (Photo Credit: Bruce N, 2009)

Usage of crop wastes was reported to be very low (as a primary fuel), but this does vary by season and area of the country, and in Nyanza crop wastes (in particular sugar cane) can serve as an important cooking fuel for some months of the year. The available data on trends suggests that over the last ten years, there has been little or no change in these high rates of reliance of solid biomass fuels in rural Kenya. There has been very little adoption of improved stoves with adequate ventilation in rural Kenya, with data from the WHO HHE database showing this to be considerably less than 5% (WHO, 2010).

Of those rural homes using solid fuels, less than 3% had a chimney or other means of venting smoke outside. Some 23% cooked in the living/sleeping area, 34% in a separate room, 39% in a separate building and 3.1% outside. While there is a marked socio-economic gradient in the use of solid fuel, it is notable that a relatively high proportion of those with higher education and in the high wealth quintile still rely on solid fuels (Annex 4).

### **3.2 Project overview**

A brief summary, starting with the project objectives, is given here as a detailed account of how the project was developed to respond to the RFP are available from the original application and subsequent reports.

The following objectives and outputs were stated in the SWAP project application (SWAP, 2010):

Goal: The goal of the project is to reduce the risk of diarrheal diseases and respiratory infections by motivating the use of household water treatment (HWT) products and innovative stoves for improvement of indoor air quality (IAQ) in rural Kenyan villages.

Objectives:

- Demonstrate the integration of HWT and IAQ into 10 of 60 villages enrolled in an ongoing program motivating the purchase and use of health interventions through social marketing, community mobilization and microfinance.
- Motivate purchase and regular use of HWT products:
  - a) Increase use of HWT products from 15 to 40% of households in 10 intervention villages.
  - b) Prefiltration of water with simple sand filters in buckets in 25% of households in 10 intervention villages relying on turbid sources.
- Motivate the purchase, production, installation, and adoption of IAQ technologies (either the Rocket Stove or Jiko Kisasa Stove) in 30% of households in 10 intervention villages.
- Evaluate programmatic approaches, adoption processes, and aspects related to the maintenance and continued use of the interventions.

The basis for the current project activity is the work of SWAP (Safe Water and Aids Project) a Kenyan NGO which began work in 2005 with the aims of delivering safe water through point of use treatment and storage, insecticide treated bed nets (ITNs), nutritional supplements and a range of other products including antiseptic skin creams and sanitary products for women. Another important activity was counselling and support for families affected by HIV/AIDS. Key to the work of SWAP has been the educational work through the methods of 'Education through Listening' (ETL) and the training of vendors/educators in all of the communities in which the NGO is working. As this latter component is very important for the combined W&S and HHE activity, it was a focus for the evaluation and is reported on in Section 3.4 below. The majority of the products promoted by SWAP are distributed by Population Services International.

SWAP has offices in 10 Districts of Nyanza province (with headquarters in Kisumu), with activities in 15 districts. It has more recently opened a provincial office in Kakamega, Western Province, with activities in 12 districts. The current project is concerned with one district of Nyanza, namely Nyando, where – working in collaboration with CDC - a research/surveillance programme (Nyando Integrated Child Health and Education Project - NICHE) was established in 2007. This covered 60 villages, delivering the SWAP household water treatment (HWT) and other products, and carrying out a controlled evaluation (30 intervention and 30 control villages) of the impact on HWT use through periodic cross-sectional surveys and bi-weekly household visits (reported use and testing for residual chlorine) and active surveillance for child diarrhoeal and respiratory disease.

From mid-2008 (in response to the successful application for the WHO integrated project funding), improved stoves (known as jiko-Upesi stoves) were added to the range of products



promoted by SWAP in 10 of the 60 villages, and surveillance continued until January 2009. More recently, promotion of stoves has been extended across all 60 villages. Surveillance was due to restart early in 2010, although the duration will be reviewed once results of the re-assessment of the impacts of the Upesi stove on HAP (PM2.5) are available (reported below).

### 3.3. Project organisation and management

The SWAP and NICHE activities are managed by a team based in Kisumu, located alongside the office of Practical Action, an NGO which has contributed to the promotion of the Upesi jiko improved stove (see below). The team in Kisumu includes the Project Director (Alie Eleveld), the Project Co-ordinator (Cliff Ochieng), the Data Manager (Iphreem Ibrahim Sadumah), Laboratory Technician (Jared Oremo Ombaka) and support staff. NICHE data is entered and managed at this office, and the laboratory is used for microbiological testing of water samples (Figure 3.3).



**Figure 3.4** Project team members - from L to R: Data manager; laboratory; project team (Kisumu) (Photo credit: Bruce N, 2009)

In respect of the current (integrated W&S and HHE) project, SWAP has one field office, located in Nyando and managed by the Field Officer, Martha Gembo. The field officer works closely with NICHE and with the communities, being involved with community mobilization and ETL training, promotion and selling (at wholesale) to vendors, and in counselling, and also in implementing and supporting the research activities. Promotion and selling of products is via HIV support groups and other community self help groups who are engaged as vendors of health products, following capacity building (see Section 3.4). The vendors drawn from these groups are mostly women, because women traditionally have been the care takers of the sick, orphans, and are the ones who take responsibility for obtaining water and cooking. There are a few groups who are mixed with both men and women participating. Men are also involved during orientation workshops and community meetings.

This evaluation was not tasked with carrying out detailed assessment of project and financial management procedures, etc. However, all of these aspects were reviewed through the interviews, viewing of some records of activity, and observation. The project appears to be well managed, staff are motivated and happy and good records are kept at both the Kisumu and Nyando (field) offices. Initially, SWAP and NICHE were managed quite separately, but are now more integrated.

The specific methods, field activities, data validity for NICHE were also not evaluated comprehensively, although some aspects – notably those relating to HAP assessment, HWT

use and testing, and the surveillance for health outcomes – have been discussed in some detail with staff. Issues thought to be of particular relevance are reported in Sections 3.5 and 3.7.

### 3.4 Education (health), product promotion and finance (loans)

Education and product promotion is central to this project. The key people in terms of delivering this are the **vendors**, who have been trained by SWAP project staff. The vendors are individuals identified from HIV support and community groups (typically two individuals per village community) most of whom are women, and who are already involved in some form of business activity, for example selling agricultural produce (Figure 3.5).



**Figure 3.5**

One of the project vendors (at rear, right) with the project and evaluation staff.

This vendor had one of the few kiosks for advertising and selling products - most would do so directly from their homes, when they visit, at meetings, etc. The kiosk contained a small stock of HWT products and stoves. (Photo Credit: Bruce N, 2009)

Initially, visits are made to the groups where SWAP is introduced and all its products are promoted, emphasizing the health and economic impacts. The groups are encouraged to use this as an income generating activity and at the same time improve their own health. The 'Education Through Listening' (ETL) method is used for all teaching. ETL is a method that has been developed by CDC/Dr Bobbie Person (Senior Behavioural Scientist, CDC, Atlanta), which places emphasis on encouraging the householder/potential customer to think about their situation and needs and how they might be able to meet these with the products available.

Once a group becomes a vendor they qualify for training. Training covers safe water (one day training for the entire group), and an introduction to microfinance services, since some groups reported that they do not have enough capital to purchase the products. Once they register with KRep (the organisation offering Microfinance services) and qualify for a loan after at least eight weeks of savings, they undergo training in business skills. This provides basic skills on how to manage a small scale business, generation of business ideas, marketing, record keeping, and so on. During the business training, they will be taken through all of the products again, their use demonstrated, and health benefits explained, together with how they can turn vending these products into an income generating activity.

A clear message from the project is that the products will not be free give-aways, and an important issue has been how hand-outs from a number of other NGOs and aid organizations (especially during floods, and drought) have interfered with the market sustainability of SWAP's activities.

Educational activities are held in a variety of settings, including schools, village meetings and with individual families in their homes. Those adopting the interventions also become advocates with their neighbours, etc.

Another important principle is that the vendors themselves become exemplars in the village, as they are users of the products, and through the trust and familiarity they have with the community, become effective advocates<sup>1</sup>. SWAP buys HWT products (Water Guard, Pur, Aquatab) from PSI at a 'bulk' price. A small mark up is placed on these products and then sold to the Vendors at a 'wholesale' price. The bulk price is given to SWAP at an agreed rate for sales mainly at grassroots to vulnerable communities. However the vendors then sell these products to their communities at a retail price, hence making a small profit for themselves. Local shop keepers buy the same products from PSI distributors and even from PSI directly, but at market rates.

Our assessment of how this system was functioning was very positive, based on accounts from project staff, vendors themselves, and users. The trust and respect for vendors was very apparent, and users seemed to show real 'ownership' of the knowledge they had gained about the value of the HWT and stoves. We judge this to be a valid observation, despite the fact that only a few users were interviewed, and that compliance is still sub-optimal - see below.

The training is quite time-intensive, but may not be (relatively) expensive: it would be useful to assess this. The same method is used across all of SWAP's operations in Nyanza and Western Kenya.

Project staff and users were positive about the ETL method, and that education should be extended as much as possible. It was suggested that there should be investment in information and education materials for specific communities, and that messages about the effects of smoke should be integrated into school health clubs. Monthly vendor forums were established in September 2009, where experience is shared, and it was suggested that these should be strengthened.

Various comments were received about the need for vendors to hold sufficient stock to meet demand, and possibly needing more financial help to do this. The project reports that the overwhelming demand for products and services has been a continuing challenge for SWAP to reach out, restock, follow up and monitor the vendors who are spread out over a wide geographical area. SWAP has been trying to ensure that each satellite office gets restocked every month but there are continuous requests for more stock which SWAP is not able to meet due to limited transport and financial resources, and issue with suppliers (e.g. subsidized ITN's). It would also be useful for the project to investigate the extent to which lack of stock (ease of supply) is suppressing demand.

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<sup>1</sup> Many of the vendors are HIV infected (or affected by HIV) and by engaging them as vendors it has helped to make them feel useful members of society. It has given them recognition by the local leaders including the chiefs who invite them to their community meetings. Some are able to give testimonies about their HIV status and how these products have made a positive health impact. This makes them very strong ambassadors and promoters and shifts their time and attention away thinking about their illness.

There was considerable awareness of the level of poverty among households, and costs of interventions, especially the stoves. The promotion periods with lower prices were repeatedly mentioned as being helpful, and calls for these to be repeated. It is not clear whether any un-subsidised price reduction is possible, however, and unless carefully managed may not be beneficial overall.

There were repeated concerns about the impact of free handouts of water treatment products by other agencies (including USAID, Red Cross), for example during crises such as floods and drought. These interfered – at least temporarily - with the activities of the project, which operates on a commercial basis. These free handouts also affected the operations of K-Rep, because vendors withdrew businesses they had started as a result of receiving free supplies and at times allowances. This situation presented a risk area for K-Rep, as they were then not sure whether vendors would be able to repay their loan if the allowance and free items stopped.

In addition, it was reported (not independently confirmed) that such handouts were not always (or even usually) accompanied by adequate education and instruction in their use. This issue would benefit from further assessment.

#### *Finance and loans*

Loans are available to vendors through the micro-finance organization K-Rep. The system works as follows. Those wanting a loan must form a group of five, and each individual can apply for a loan of up to 50,000 KSh/- . They have to open a joint account, although each has their own sub-account within this. Initially, they must save for 8 weeks before accessing the loan. The first loan taken out is set to a maximum of 15,000 KSh/-, and this must be paid back within 6 months. In practice, most loans are relatively small, and paid back within 6-8 weeks. Interest rates are 13%, which is favourable in Kenya (30% is common), and the loans have to be repaid within 12 months.

The vendors use the loans to buy products at wholesale, but they are not restricted to SWAP products - indeed as these are relatively slow moving and have small profit margins, vendors also buy and sell other commodities.

Overall, this system seems to be operating quite well. Most vendors are using it, although some are suspicious of taking loans, not trusting others in their group to pay back. There had been initial problems with K-Rep staffing, and this is still restricted and hence the process can be slow (and more K-Rep capacity is needed), but overall the loan facility seems to provide vendors with an important opportunity.

K-Rep does also have a limit on the number of groups they can take on, so a lot of other vendors have been operating without microfinance services or have been opting for their own “merry go rounds” within the groups. These operate as follows: every month each group member brings a fixed amount of money which is donated to one of the group members who can then start a small business. The next time, the same applies to another member and this goes round until the entire group has benefited. It has been a very common activity among the groups and indeed had often been the basis for starting some of the groups.

Some vendor groups have developed a payment in kind option, involving chickens, labour or firewood.

Finance (micro-credit) facilities are not currently available through this system (or any alternative so far as we could ascertain) for individual households for purchase of, for example, an Upesi stove. To address this, it was suggested that an 'asset acquisition package' should be developed that would be applicable to the poorest members of the community. K-Rep has recently (2010) introduced asset loans which could apply to stove purchases, but they only provide this to groups who have already serviced one normal loan and who have not been defaulting.

### 3.5 Intervention efficacy, effectiveness and efficiency

#### 3.5.1 Household water treatment

Table 3.2 lists the products available - and in use - in project area, together with information on costs, and consensus views on advantages and disadvantages. The main products are illustrated in Figure 3.5.

**Table 3.2** HWTS products available and in use in project area

Product (and active content)	Cost and volume of water treated/stored	Advantages	Disadvantages
WaterGuard Sodium hypochlorite 1.2% 150 ml bottle	<b>Introduced by SWAP in 2005</b> Currently 25 KSh (W/S); 30 KSh (R/T), sufficient for 1000 litres (about 6 weeks). Very widely available	Cheap and good value for money. Widely available. Easy to use, as bottle cap provides the measure for 20 litres. Ready in 30 minutes.	Has quite a strong chlorine taste, which seems to put some people off using it, although user views vary widely on how much of a disincentive this is.
PuR Flocculent & disinfectant (Iron sulphate and Calcium hypochloride)	<b>Introduced by SWAP in 2006</b> Currently 4 KSh (W/S); 5 KSh (R/T), sufficient for 10 litres. Availability recently improved	Flocculent, so good for clearing turbid water, e.g. from the river. Effect is like a 'magic show', which is impressive. Also contains iron (but this information is not widely promoted)	Cost is relatively high, and one-time use (sachet). Not easy/quick to use: product is a powder, need bucket, cloth to filter, and need to stir for 5 minutes. Not as widely available as WaterGuard. Profit margin is very small for vendors.
Aquatabs Sodiumdichloro-isocyanurate	<b>Introduced by SWAP in 2007</b> 1.8 KSh (W/S); 2.0 KSh (R/T) per tablet, sufficient for 20 litres. Availability recently improved.	Very easy to use: place in water, dissolves, ready in 30 minutes. Milder taste than Water Guard. Convenient for use when away from home (e.g. at funerals)	Cost higher than WaterGuard, and not as widely available. Some people (a minority) mistake the tablet for a medicine, and swallow it, or as tablets are seen as 'medicine', this is a disincentive for routine use. Commonly, there no message about how to use the product when sold in shops
Narrow neck clay storage jar	<b>Introduced by SWAP in 2005</b> 20 litre 360 KSh (W/S); 370	Traditional style and material. Narrow neck allows	As ceramic, subject to breakage. Some develop

Product (and active content)	Cost and volume of water treated/stored	Advantages	Disadvantages
with tap	KSh (R/T), 40 litre 560 KSh (W/S); 570 KSh (R/T),  mainly for domestic use	cleaning, but not extraction of water with a cup - there is a tap. The cooling effect of the ceramic pot is valued	leaks around the taps.
Plastic bucket with lid and tap	<b>Introduced by SWAP in 2005-6</b> 20 litre 340 KSh (W/S); 350 KSh (R/T), 60 litre 540 KSh (W/S); 550 KSh (R/T), 60 litre version used by schools, churches, market centres, etc	Large capacity valued. It is high enough that small children cannot access the lid.	Not aware of any

W/S = wholesale      R/T = retail



**Figure 3.5: Left to right: water treatment products; modified clay storage jar; plastic (60 litre) covered bucket**

In general, all groups of people interviewed expressed similar views about these products.

SWAP initially planned to use sand filters, but this has not been practical due to lack of availability of the materials in or near most communities. The feasibility, usage and health impact of LifeStraw in poor rural communities is currently being evaluated. SWAP is also (currently) entering a partnership with PATH US to introduce ceramic filters into the basket of products and distribute and promote them through SWAP's field officers and vendors network.

### ***Efficacy***

The efficacy of all of the water treatment products has been established in the scientific literature, and will not be further discussed here.

### Effectiveness

Effectiveness depends on how the products are used in practice, hence 'user compliance' is critical. There were a number of data sources available to us from which to assess compliance, although data from the bi-weekly household visits are not yet available. Table 3.3 summarizes key compliance information, both reported use and confirmed by testing for chlorine residue, from repeated cross-sectional surveys.

**Table 3.3: Compliance with use of HWT (reported and confirmed) in repeated cross-sectional surveys of various groups in the NICHE study group, and additional users of jiko improved stoves (Source: CDC, 2009)**

Stage of project	Survey group	Date	Total number	Reported use		Confirmed use	
				N	%	N	%**
<b>Before starting the IAQ component</b>							
NICHE Baseline	49 non-IAQ* villages	March 2007	839	337	40.2%	70	8.9%
	11 future IAQ* villages		210	90	42.9%	30	15.1%
1 <sup>st</sup> NICHE follow-up	49 non-IAQ* villages	March 2008	961	521	54.2%	56	6.1%
	11 future IAQ* villages		229	121	52.8%	22	10.4%
<b>After starting the IAQ component</b>							
2 <sup>nd</sup> NICHE follow-up	49 non-IAQ* villages	March 2009	564	425	75.4%	89	16.6%
	11 future IAQ* villages		142	104	73.2%	19	14.0%
<b>Water treatment survey in IAQ villages</b>							
All NICHE households		Nov 2009	286	126	44.0%	94	32.9%
Non-jiko using NICHE households			232	90	38.8%	63	27.2%
Jiko-using NICHE households			54	36	66.7%	31	57.4%
Non-NICHE jiko using households			114	71	62.3%	46	40.4%
All jiko-using households			168	107	63.4%	77	45.8%

\* IAQ = Indoor air quality: this refers to villages that either would, to would not, have improved stoves promoted in the integrated water and IAQ phase of the project, from mid-2008

\*\* [Note: percentages for the confirmed use in the NICHE baseline and two follow-up surveys are slightly high for the stated total number in sample (denominator), and it is assumed that some subjects who reported use were not tested]

These survey findings show quite mixed results. At NICHE baseline, around 40% reported using HWT, but less than 10% had this confirmed - as this was pre-intervention, these results are perhaps unremarkable. However, at 1<sup>st</sup> follow-up, only about 50% reported use and slightly lower percentages were confirmed to be using chlorine. At 2<sup>nd</sup> follow-up the situation was slightly improved, with around 75% reporting use, but only about 15% confirmed.

In the villages where the integrated water and stove interventions were being promoted, there was a more encouraging picture, particularly among those households that were using the improved stove. In these, around two-thirds reported using HWT and between 40 and 57% were confirmed, with the highest confirmed use in NICHE study group homes (57.4% confirmed, although a relatively small sample of n=54 homes in total).

Overall, these results indicate that compliance is still sub-optimal, but that it is highest in those communities where the integrated intervention is being delivered. Surveillance was ongoing during the NICHE 1<sup>st</sup> follow-up, had just stopped at the time of the 2<sup>nd</sup> follow-up, and had stopped for 10 months in the case of the November 2009 assessment. This needs to be borne in mind when interpreting the likely sustainability of HWT use outside of the

surveillance periods, particularly for the awaited results from the bi-weekly home visits (all of which are in surveillance, by definition). Perhaps surprisingly, the highest compliance has so far been recorded almost a year after surveillance ceased, and it may be that the integrated messages and promotion of HWT, stove and other products is playing a part in this. This and related issues are discussed further in Section 3.6 on Synergies.

**(iii) Efficiency**

No formal attempt this far has been made to carry out formal economic evaluation of the HWT interventions, as this was not planned and budgeted for.

**Additional information on experience with HWT products**

There were somewhat varying views about the range of products, with most project staff feeling this was adequate, but some felt it would be good to try both (i) Lifestraw and (ii) sand filters (CO), if possible.

Incentives were used to increase uptake, with a price reduction on Upesi stoves in October 2008 of 50 KSh (which has been retained), and in September/October 2009 of T-shirts for vendors installing at least 3 stoves per week. The October 2008 promotion also involved HWT vouchers of 20 KSh, when on buying and installing a stove (CO). There was some support from the interviews with some vendors and users for the observation from the data (above) that HWT use was more consistent among stove users.

**3.5.2 Improved stoves: reduction of household solid fuel air pollution**

The traditional stove used by most rural households in Nyando is a 3-stone fire on the floor of the kitchen. The kitchen may be in a separate building, but is frequently used as a sleeping room by some members of the family, including children. The stove products available and in use in project area are listed in Table 3.4. The Upesi stove as used in the current project is illustrated in Figure 3.7.

**Table 3.4:** Stove products available and in use in project area

Product	Cost		Advantages	Disadvantages
	Stove	Installation		
Upesi jiko	<b>Introduced by SWAP in 2008</b> 190 KSh (W/S); 200 KSh (R/T),	Built into kitchen, with ventilation window, at cost of 50 KSh	Once installed, easy to use. From visual appearances, and user reports, seems to produce less visible and irritating smoke (although this depends on how dry the wood is – with wet wood, it is smoky). Also said to cook faster and use less wood/more food cooked for same amount of wood. Food smells less of smoke. Less coughing. Looks good, and has status, a 'step ahead'.	Still viewed as quite expensive. Only one group in Nyando is currently making the stove and increases in transport distance and have led to increases in cost. In some Luo households where there are multiple members of the family (wives), it is the custom that the older woman needs to adopt first. In small homes/kitchens, some commented it takes quite a lot of space (compared with the 3-stone fire)



Product	Cost		Advantages	Disadvantages
	Stove	Installation		
Portable Upesi jiko	<b>Introduced by SWAP in 2008</b> 690 KSh (W/S;) 700 KSh (R/T),	Portable - used outdoors or indoors	As for standard stove, but in addition can be used outdoors during dry weather. Avoids cost and trouble of installation.	Main issue is the cost
Rocket stove	N/A	N/A	Not promoted due to relatively high costs and poverty of target population	
Clean fuel	N/A	N/A	No other stove products currently being promoted	



**Figure 3.7:** (Left) standard Upesi (front) and portable type (behind), displayed at SWAP office; and (right) standard Upesi built into a kitchen and in use (Photo credit: name, year).

In considering efficacy, effectiveness and efficiency, there are two key functions (or impacts) of the stove that can be assessed, namely (i) changes in kitchen levels of air pollutants (also, if possible, in personal exposure levels for the cook, children, etc.), and (ii) changes in the efficiency (combining combustion and heat transfer), typically assessed through the amount of wood fuel used to carry out everyday cooking tasks. Another critical issue for effectiveness (and hence efficiency), is how well the stove meets household needs, ease of use, whether it is reasonably robust, and whether it is maintained and repaired/replaced as needed.

### ***Efficacy***

Efficacy of stoves would normally be carried out in 'laboratory' type conditions, for example a test-house, which is typical of rural homes, but in which various circumstances can be controlled. Efficacy tests have not been carried out as part of the NICHE/SWAP project, and we are not aware of any other independent evaluation of this model of the stove, either for emissions/pollution levels or fuel use.

### **Effectiveness**

No data was available to us on numbers of Upesi stoves adopted in each community, and % adoption among open fire users in the study villages. This should be available from (i) vendors records of stoves sold and (ii) population data from the study sampling. This should be done at least for the 10 integrated study villages, and now that stove promotion is being extended into the rest of the NICHE area, uptake in the remaining 50 villages should also be monitored. In addition to sales, monitoring should also be done in actual use.

Regarding impact on smoke levels, a number of studies were carried out during 2009 to measure the effect of the Upesi stove on (i) 48-hr kitchen PM<sub>2.5</sub> using the UCB monitors with standard protocols provided, and (ii) time for cooking, using the standard ‘controlled cooking test’. The results are summarized below (further details and protocols available on request).

### *Impact on indoor (kitchen) concentrations of PM<sub>2.5</sub>*

Two sets of independent group comparisons were made during the year on 12 (13 in second round) homes (Table 3.5), and one paired (before and after) comparison on four homes (data not shown in table).

**Table 3.5:** PM<sub>2.5</sub> levels measured over 48 hours in neighbouring homes (pairs - see below), on two occasions in 2009 (Source: Eleveld A, 2009).

Pairs of Homes*	Mean PM <sub>2.5</sub> (Standard Deviation) February – March 2009		May – June 2009	
	3 stone firepit	Jiko Upesi	3 stone firepit	Jiko Upesi
Pair 1	0.76 (3.20)	0.29 (1.13)	0.65 (3.11)	2.88 (14.09)
Pair 2	0.35 (1.89)	0.54 (2.04)	1.05 (3.97)	0.79 (3.29)
Pair 3	0.67 (1.79)	1.08 (4.41)	0.53 (2.15)	0.30 (2.02)
Pair 4	0.80 (3.34)	0.56 (2.15)	0.44 (1.12)	0.75 (2.68)
Pair 5	2.46 (7.58)	0.55 (0.41)	0.38 (1.20)	0.45 (1.46)
Pair 6	0.24 (0.86)	0.31 (0.28)	0.54 (3.92)	0.34 (1.11)
Pair 7	0.10 (0.10)	0.62 (1.34)	0.20 (0.08)	5.97 (0.79)
Pair 8	1.71 (5.54)	0.25 (0.61)	1.24 (2.99)	0.13 (0.64)
Pair 9	-	-	0.32 (1.71)	0.40 (1.83)
Pair 10	0.38 (0.76)	0.54 (2.41)	0.25 (0.61)	0.32 (1.66)
Pair 11	0.66 (1.46)	0.49 (1.40)	1.38 (3.85)	1.92 (7.14)
Pair 12	0.48 (1.39)	2.17 (1.18)	0.09 (0.26)	0.66 (2.45)
Pair 13	0.34 (1.24)	0.74 (1.54)	0.28 (1.12)	0.71 (2.54)
Mean**	0.746	0.678	0.565	Not calculated as very skewed
% Reduction**	9.1%			

\* These are neighbouring homes but not formally matched, so the sample should be seen as two independent groups of n=13.

\*\* Calculated by NB

The first set (Table 3.5) compared homes with Upesi stoves, with their nearest neighbours using an open fire. The sample size was small for independent group comparisons (n=30 would probably have been more appropriate). For the February/March set, the Upesi homes had PM<sub>2.5</sub> concentrations only about 10% lower. For May/June, the difference is difficult to interpret as two of the Upesi homes recorded very high levels. A before and after comparison in four homes showed a reduction with the Upesi of just 19%. As a result of these rather small and inconclusive results, further assessment of the stove was carried in early 2010, in before and after comparison using the same protocols (Table 3.6). The number of meals cooked per day was very similar for the 3-stone fire and Upesi assessments. For 48-

hour kitchen PM<sub>2.5</sub> concentrations, there was a small reduction of around 14%, not quite significant at the 5% level (p=0.07).

**Table 3.6:** PM<sub>2.5</sub> Monitoring and Cooking Habits of Pre- and Post- Jiko Upesi Installation in 27 Select Households (Modified from SWAP/NICHE, 2010).

Factor	Traditional 3-stone stove (n=27) Mean (SD)	Upesi jiko (n=27) Mean (SD)	% Difference	p-value
<b>PM<sub>2.5</sub></b>				
Geometric mean	0.126 (0.039)	0.109 (0.038)	-13.5%	0.07
<b>Fuel consumption</b>				
Number of sticks used per cook period	4.36 (3.47)	3.03 (1.78)	-30.5%	0.001
Fuel cost per cook period (Ksh)	10.62 (8.02)	7.85 (4.51)	-26.1%	0.005
<b>Cooking Factors</b>				
Mean number of meals per day	7.15 (1.85)	7.19 (1.78)	0.6%	0.846
Mean time per meal (hours)	1.17 (0.57)	1.05 (0.37)	-10.3%	0.032
Time stove used per day (hours)	7.95 (3.14)	7.54 (2.78)	-5.2%	0.539

The results for reduction in PM<sub>2.5</sub> are somewhat surprising as reports from users, observations of project staff, and our own observations in homes where Upesi stoves were being regularly used indicate that smoke levels and irritation of eyes, coughing and headaches, are said to be reduced. It could clearly be seen that kitchens were cleaner, (Figure 3.8). Both users and project staff report that kitchens were considerably cleaner following installation of the Upesi stove, with less soot deposits on walls and utensils. The black soot seen on the wall in Figure 3.8 was from the previous 3-stone fire located in the corner of the room. Attempts to clean the soot from the wall are clearly apparent, and pots have now been arranged close to the stove.



**Figure 3.8:** Upesi Stove in Kenyan home (Photo credit: Bruce N, 2009)

There is also evidence that women have improved the appearance of the kitchens, put pots and pans near the stove, and so on, also illustrated in Figure 3.8. Possible explanations for these findings, and implications for (i) further testing and (ii) scaling up, are considered further in the Conclusions for Kenya (Section 3.9) and in the overall Kenya Project Recommendations (Section 5.1.2).

### *Impact on fuel use*

During the 2010 stove assessment, the 'Controlled Cooking Test' (CCT) was used to determine fuel use and time spent cooking (Table 3.6). Compared to the PM<sub>2.5</sub> changes, there were larger, statistically significant reductions in the amount of fuel used (around 30%) and associated costs (26%), and some evidence of reduced time spent cooking (10%) but no difference in the total time the stove was used during the day. A similar CCT carried out among just 4 homes earlier in the study (and reported in 2009) is shown in Table 3.7, and showed no evidence of time saving for the Upesi in comparison with the open fire.

Based on the 2010 study (Table 3.6), in contrast to the findings for PM<sub>2.5</sub>, the results for fuel (and possibly time) saving are much more consistent with reports from users, who all stated that the new stove cooks more quickly. It may also be useful to conduct Kitchen Performance Tests (KPTs) which capture the fuel needs for up to a week of cooking in typical circumstances.

**Table 3.7:** Comparison of cooking times for preparing four different dishes in four homes, with the open fire and the Upesi in a before and after design. PM<sub>2.5</sub> (during cooking for the CCT) was also measured (Source: Eleveld, 2009).

Household ID (HH)	Stove type	Time (total min.)	Mean PM <sub>2.5</sub>	Meal type
1	3 stone firepit	10:38-11:05 (27)	0.003	Vegetable
1	Jiko Upesi	12:21-12:48 (26)	0.43	
2	3 stone firepit	11:58-12:13 (15)	0.003	Ugali/maize
2	Jiko Upesi	10:57-11:12 (15)	0.43	
3	3 stone firepit	12:04-13:13 (69)	5.60	Fish
3	Jiko Upesi	11:50-13:04 (74)	0.72	
4	3 stone firepit	11:35-12:04 (28)	0.66	½ kg. rice
4	Jiko Upesi	10:42-11:20 (38)	0.37	
Mean of time differences (min)*		+ 3.5	Not assessed**	
% change (Upesi vs. 3-stone fire)*		2.5% increase		

\* Calculated and added by NB

\*\* Not assessed because two of the values for open fires (houses 1 and 2 are so low as to be inconsistent with use of the fire.

### ***(iii) Efficiency***

No formal attempt this far has been made to carry out formal economic evaluation of the stove interventions, as this was not planned or budgeted for.

### ***Additional information on experience with the stoves***

A clear message from a range of staff, and some users (involved in promotion) was on the need to increase the number of production centres for the Upesi. In addition, transport is problematic and expensive. Having production closer to some of the communities would help.

Some staff felt that the market would benefit from more variety in types of stove, although views differed on this. This view was at least in part driven by the recognition that there needed to be a much larger reduction in HAP (PM<sub>2.5</sub>), and if the Upesi could not deliver this, alternative(s) were needed. The rocket stove is much more expensive (around 3,000 KSh), and has not been tested locally (there is at least one study carried out in Uganda of a similar

type). There was some interest in trying some form of chimney or hood, in a sample of homes, although the higher cost was recognised.

Price was a key issue for many. Incentives were used to increase uptake, with a price reduction on Upesi stoves in October 2008 of 50 KSh (which has been retained), and in September/October 2009 of T-shirts for vendors installing at least three stoves per week. The October 2008 promotion also involved HWT vouchers of 20 KSh, when on buying and installing a stove. One user was unclear about whether she could use sugar cane as fuel in the Upesi. It would be useful to assess how common this uncertainty is, and ensure appropriate advice is given.

### 3.6 Added value of integrated delivery: Synergy

The assessment of synergies, that is the 'added value' of delivering these interventions in an integrated way, was a key evaluation objective. We should be clear that neither the project, nor our evaluation, are able to demonstrate scientifically that delivering both W&S and HHE interventions together has a synergistic effect over and above what may be seen from these interventions delivered independently. The issue of whether effort can and should be made to study this is considered in the Research Recommendations (Section 5.3).

We used the framework in Table 3.8, derived from the background paper by Clasen and Biran (2009) in order to summarise the advantages and disadvantages reported and observed during the evaluation visit.

**Table 3.8** Areas of synergy for integrated delivery

#	Area of potential synergy or antagonism	Synergy (Benefit)	Antagonism (Shortcoming)
1	Government policy integration: <ul style="list-style-type: none"> <li>National</li> <li>Local (city, province)</li> </ul>	At present government policy is not 'joined up'. Synergy at this level may be possible if success (e.g. of the current project) is promoted. Government structure could respond, but it will take time.	No substantial issues identified
2	Situation analysis (e.g. baseline survey) applies to both issues	This was not a problem in practice, especially once the communities were mobilized and there was a well-trained team.	No substantial issues identified
3	Combined technology and/or production	The stoves and HWT products are made separately	N/A
4	Combined supply, distribution, outlets	This is an advantage through the vendors	No substantial issues identified
5	Combined business opportunities	This is seen for the vendors and seems to work well, and one vendor said that she could obtain greater sales by combined approach.	No substantial issues identified
6	Potential health benefits from combination: <ul style="list-style-type: none"> <li>Reduced HAP from less need to boil water</li> <li>More water available for hand washing</li> </ul>	Possibly less firewood being used to boil water [note that, traditionally, water is heated on fire after cooking is done, but without additional wood to ensure it is properly	Message can get a bit diluted. Possible risk that households will boil water less, at the same time as using HWTS inconsistently. This could be assessed in follow-up.

#	Area of potential synergy or antagonism	Synergy (Benefit)	Antagonism (Shortcoming)
	<ul style="list-style-type: none"> <li>Other (specify)</li> </ul>	boiled]	
7	Combined educational (health effects) initiatives: <ul style="list-style-type: none"> <li>Actual content</li> <li>How delivered</li> </ul>	Makes sense from public health perspective. People are receptive, as meets priorities they recognize. Vendor role works, as trained, trusted member of community. Household have option to prioritize from among the range of products. It is efficient (it would be less efficient to duplicate this role)	Possible risk with linked products is perception that if don't have one (e.g. Upesi), then do not need to use the other (HWTS) This could be assessed further by interviewing a sample of homes, including non-users of either intervention. .  No other or substantive disadvantages were identified
8	Combined promotional messages for products: <ul style="list-style-type: none"> <li>Researching approach</li> <li>Individual sensitization</li> <li>Community sensitization &amp; mobilization</li> <li>Other (specify)</li> </ul>		
9	Finance: <ul style="list-style-type: none"> <li>Support (subsidy, loans)</li> <li>Competition for limited household resources</li> <li>Other (specify)</li> </ul>	Finance (loans) for vendors allows them to promote and sell both products	No substantial issues identified
10	Opportunities for integrating additional activities/products <ul style="list-style-type: none"> <li>Specifically health-related</li> <li>Other (specify)</li> </ul>	This is seen with the other products promoted, including ITN, sprinklers, etc., and also advice about hand-washing and use of soap. All vendors are trained in ETL, and discuss health and other products. Vendors have a minor community care worker role (in providing advice when members of family sick) - the potential of this role is further considered in discussion.	No substantial issues identified

In summary, this assessment found that the integrated delivery of products for improving the household environment was overwhelmingly positive. We judge the key advantages to be:

- Users saw the value and 'sense' in finding out about a range of household products that offered solutions to the main health problems that they faced - respiratory illness, diarrhoea and cholera, malaria, etc.
- Even if they were not able to buy all the products they wanted when first contacted by vendors, they could think about this and plan for future purchases, e.g. by starting to save for a Upesi.
- It is difficult to judge whether compliance is better with an integrated approach. The initial results for HWT products, and impressions gained during the evaluation, suggest that this could be the case. This is an important issue to study further, as HWT, sanitation (e.g. hand-washing) and stove programmes have been beset by problems of compliance over the longer term. This is considered further in the Research Recommendations (Section 5.3).
- It would appear (at face value) to be more cost-effective, possibly considerably more so, to deliver a range of products through a single programme of supply, educator/vendor training, etc., rather than with two or even multiple separate programmes. Vendors may also be benefitting from enhanced business through a combined approach. These issues should also be assessed in future work.

There were no important disadvantages to the integrated delivery. It should be noted however, that this observation may not apply in other situations that do not have the quality of organization and community engagement shown by the SWAP/NICHE project. The panel below (Figure 3.8) tells the story of one poor, rural mother, and illustrates well the way in which the SWAP project is functioning, the way in which knowledge seems to be becoming 'owned' by the community and the benefits of the combined delivery of HHE and HWTS information and products.

**Mary's story** [not her real name]

Mary lives with her husband and two children in a fairly remote rural area of Nyando district. They own their home, which has two rooms. Apart from a mobile phone, she does not have any other electrical goods, and no mains electricity to her home. She obtains water from a bore hole, or from a pond depending on the season. She cooks mostly on a 3-stone fire indoors with wood collected locally, or on occasions using charcoal which her family makes (see photo, bottom right). She used to boil water for drinking, and for the last 2 years, she has used WaterGuard for treating drinking-water, stores it in a clay pot with a tap (see photo, bottom left) and cleans this every 2-3 days. She found the project vendor to be very persuasive, and describes herself now as being very committed to using water treatment regularly. She was also told by the vendor about the Upesi, and is now determined to obtain one, so is saving up for this. The fact that the vendors started using these products served as an example and stimulus for her and her neighbours.



**Figure 3.9** Mother who treats her household drinking water



### 3.7 Evaluation research

Our recommendations for future research are presented and discussed in Section 5.3. Here, specific comments on evaluation research are noted:

- In general, the research arm of the project was highly valued. The main results on uptake, compliance and health outcomes are awaited.

- The need to re-assess the impact of the Upesi on HAP levels was recognized, and this will be carried out in early 2010.
- A proposal was made to carry out a study with chimneys.
- The importance for evaluation over a longer follow-up period was also mentioned, to study the effects of the rainy season, and of times when there is less income, etc.

### **3.8 Scaling-up and integration with government**

A range of views were obtained on the prospects for scaling up the activities, locally, regionally and nationally, and for working and co-ordinating with government. These perspectives are contextual on the position and responsibilities of the respondents, and are therefore reported separately for each.

#### *Project Director*

Stove promotion could, and should, be extended across the whole SWAP activity area, that is Nyanza and the Kakamega area in Western Kenya. SWAP already has the delivery model in place, that is the trained field officers, across all their activity area in Nyanza and Western Province. Further needs include the practical training on installation for the community groups and vendors. Nationally scaling up in this way would be possible through partnership with other organizations outside the SWAP area of operation of Nyanza and Western Kenya.

HENNET (a Health NGOs Network established in 2005), of which SWAP is a member (and on Board since 2009), is a para-statal organisation that co-ordinates the work of NGOs. HENNET could provide one means of co-ordinating delivery of HWTS and HHE (plus other) products and activities through SWAP (and potentially other groups using similar approaches) with government policy (Ministries of Health Services, of Public Health and Sanitation, and of Water Supply, among others), and also co-ordinate across the country.

CDC and the Partnership for Clean Indoor Air (PCIA) should also have a role in scaling up.

#### *Project co-ordinator*

There is already some evidence that vendors are selling outside of the study area. It should be possible to scale up at province level, but it should also be recognized that it may take some time and effort to adapt to different realities and incentives in other parts of the province. Nationally, if there was policy backing, standards on products, etc., and the necessary resources, there is no reason why the current approach should not work.

#### *Vendor*

In response to the question of what would happen if SWAP 'ceased', the vendors felt that they could, and would need to as the 'community would demand it'. However, to succeed, they would need to find a way of obtaining the products. It was not clear to us how they would do that.

#### *Public Health Officer, Nyando*

The Ministry of Public Health and Sanitation is aware of the SWAP activities. Regular stakeholder meetings are held which involve all NGOs, such as SWAP, which are providing public health services. At these meetings, they are encouraged to discuss current and



planned work, with the aim of co-ordinating provision, avoiding overlap, etc. The officer or one of his colleagues tries to attend community and school promotional meetings, if they have time.

They see HWT as a critical policy, due to lack of safe water supply, although this is responsibility of Ministry of Water Supply. They are also aware of problems of smoke pollution, but not very familiar with Upesi stove. Newly constructed homes in more urban areas have to meet building regulations, with provision of a chimney, but they realise this cannot cover traditional rural homes.

They value work of SWAP, recognizing that they cannot do all of this. The officer has only 3 field officers working with him for a population of (estimated) 30,000. He sees ownership by the community, and input into schools as being particularly important, and would like to see extension of work with schools. For example, schools not currently using water treatment, safe storage and hand-washing, could learn from those who have adopted use.

The officer agrees that the combined (integrated) message has value, but had no strong view on this. He did express view that once SWAP activities (in particular, in schools) had reached a certain level, the Ministry could take over responsibility, but could not say whether the required resources or capacity would be available to do this. One can assume this is unlikely, given current circumstances that he described.

He recognized concerns about sustainability, costs of transport, etc., requiring ongoing input of resources to SWAP.

*WR/Kenya – Dr David Okello*

The WR was briefed prior to and on the last day of the mission.

He confirmed that the issue of water and sanitation is critical in Kenya, and diarrhoea/cholera a major concern. There is a very low level of safe water supply, even for towns, thus HWTS remains a critical element of public health policy for the foreseeable future.

The Ministry of Public Health and Sanitation is looking for technical advice on how best to implement this, alongside development of a policy document that has been initiated with the AFRO regional office.

The issue of HAP, and risk of pneumonia and other health consequences, are fully recognized as important, and Dr. Okello sees the key issues as (i) a general lack of awareness and (ii) the need for effective, affordable interventions for use at scale in poor communities.

Dr Okello felt that the current project was potentially highly relevant, and that it would be useful to discuss this with the Minister. He will also obtain further, more specific information on the nature of the technical support being sought with respect to water and sanitation.

He supported the proposal for a follow-up workshop, and would be able to assist with this if held in Kenya (which was encouraged).

The issue of policy on/methods for treatment of wells in the north-east of the country was mentioned, a topic which could also be included in a follow-up workshop. As mentioned that, although this could be effective, it was important to also consider how to avoid re-contamination during transport and storage.

### **3.9 Discussion and conclusions**

This is a very well managed project, which uses educational methods to empower poor households with knowledge about how various products can improve health of families, and encourages through example. The vendors, local members of the communities who are essentially running small-scale business operations and mostly supported by (relatively) low-cost loans, are key to this role. Their involvement with schools also appears to be important and is valued by the Ministry of Public Health and Sanitation. It is not clear whether and how the NICHE evaluation will be assessing the impact on and through schools.

The promotion of products is commercially sustainable as these are sold at cost with a small mark-up for the vendors, although this is episodically compromised by free handouts of water treatment products during floods and other crises. Overall, this appears to be an effective and robust model for sustainable delivery. Like all such NGO-led activities however, it was not entirely clear to us how well this system would 'survive' if SWAP funding and key, highly competent personnel, were no longer managing the programme. Vendors are very committed, and recognize community demand, but are unsure whether they would still be able to access the products. SWAP has developed a business plan to ensure sustainability, but reports that fundraising for this process has been slow.

The products themselves have the potential to impact on a range of high priority disease conditions for child survival in Kenya, namely pneumonia (Upesi stoves), diarrhoea (a range of HWTS products and hand-washing soaps), malaria (ITNs and mosquito repellent) and under-nutrition (sprinkles, fortified flour).

#### *Water treatment and storage*

The effectiveness of HWT products depends on compliance in everyday use. Further data analysis is needed to complete the picture, but results available to date show compliance across the NICHE area to be moderate, reaching (at best) 66% reported use and 57% confirmed by chlorine residual testing in the 10 integrated project villages among improved stove users.

This level of compliance may however be relatively good, in terms of what can be achieved, in practice, with HWTS. Although compliance appears to be highest where combined interventions have been promoted and adopted, this needs further formal analysis, adjusting for socio-economic and other confounding factors. It is also important to recognise the effect of participation in a study with frequent home visits which may inflate compliance in a non-sustainable way.

#### *Improved stoves*

We are not aware of any other/prior studies of the efficacy of the Upesi stoves, specifically in terms of HAP reductions in ideal ('test-house') circumstances. However, (repeated) testing of

indoor air pollution levels suggest very modest reductions in PM2.5 of 10-20% at best, although savings of time and fuel have been demonstrated. Based on everyday experience in the project, these stoves appear to be well-liked and well-used, and are reported to save wood, reduce smoke and the consequent irritation, cough, headaches, etc., as well as the level of soot in the kitchen. Women have re-organised their kitchens in response to this, bringing pots and other utensils much closer to the stove. The reasons for this inconsistency between field experience and test findings for smoke pollution are not clear, as reductions in ambient kitchen PM2.5 of somewhere around 40-50% (at least) might have been expected given the reported improvements in smoke irritation and in the kitchen environment. The project team used an established protocol and equipment for making the measurements.

Information on the numbers of stoves adopted in each community, and hence level (%) of uptake, was not reported across the study area or available to us (although these data should be available from vendor records, and community populations from the survey sampling work). While effectiveness of the stoves remains open to question and will be further assessed once the new measurement results are available, the model of promotion and sale of a cook-stove product that is well-liked and used is an important achievement and of value for the future of the project.

#### *Synergies*

The approach of combining the promotion and delivery of HWTS and HHE products met with across the board positive responses from project staff, the vendors, the community and the District Officer from the Ministry of Public Health and Sanitation. It appears more cost-effective than if the same products were promoted through separate programmes. Combined delivery may also achieve higher compliance, but this does need further formal analysis. There were no substantive concerns with any of the criteria identified from the background review paper.

#### *Impact on health outcomes*

Analysis of the results of the impacts of the interventions on diarrhoea and pneumonia incidence is awaited. It can be expected that the reported level of compliance with water treatment would have some impact on diarrhoea, particularly where the higher levels have been reached. On the other hand, the very modest reduction in PM2.5 levels recorded for the Upesi stove would not be expected to lead to substantial reductions in risk of pneumonia or ALRI.

An interesting issue is the role of the vendor as a community health worker. In addition to promoting and selling products which have the potential to prevent important childhood disease, the vendors inevitably have a role in giving advice when visiting the home or community where members of the family, including children, are ill and on occasions seriously ill. The vendors are trained in home remedies and advising parents to seek care, but not formally trained in community-case management. Given their position of trust in the community, and capacity to educate and promote these important products, some consideration could be given to assessing whether their role could extend to community case management for diarrhoea and pneumonia (at least). One concern however, is supervision, as currently the vendors do not work in a system where work of this nature could be supervised.

### *Sustainability and scaling up*

The two linked issues of sustainability and scaling up also appear positive, although both also depend to some degree at least on the existence and *modus operandi* of SWAP. The vendors spoken to were committed to continuing their work, even if SWAP ceased operations, but only if they could still obtain the products. It is not clear whether and how dependent they actually are, in practice, on the support, encouragement and management capacity of SWAP. Given the fact that SWAP operates a similar methodology across its whole area of operations for delivering the water treatment, ITN and other (original) set of products, it does seem reasonable to assume that delivery of these plus the stoves would also be possible across this much larger area. This does however assume that suitable (and effective) stoves are available and produced across a number of centres. This also relates to the issue of whether the Upesi is a sufficiently effective device in terms of reducing PM2.5 levels, or whether alternative(s) are needed. Nevertheless, it does seem that there is potential to scale up the delivery approach across a considerably larger population.

### *Co-ordination with government and other agencies*

The recent emergence of HENNET (a network of health-related NGOs in Kenya, established to coordinate between the NGOs and with government) is also promising, but the potential contribution of this organisation to supporting co-ordinated, scaled up delivery will have to be assessed more thoroughly.

## **4. SYNTHESIS OF EXPERIENCE FROM CAMEROON AND KENYA**

In bringing together the experience from the two country projects, it is clear that there are a number of features in common, and some distinct differences. These are highlighted in this section.

### **4.1 Project funding and organisation**

Both of the projects are essentially conceived and managed by NGOs, relatively independent of government. In Cameroon, the project is supported by GTZ, and the community work organised by ACMS, the national arm of PSI. In Kenya, the project is run by SWAP, with products supplied by PSI. While in Kenya the government (Ministry of Public Health and Sanitation) is interested and supportive with a mechanism for liaison and coordination (albeit relatively uninvolved), in Cameroon the local government authority has not provided any active support and indeed appears to have undermined the project.

### **4.2 Products**

#### *Water treatment and storage*

In both countries, the main point-of-use product is WG. In Cameroon, there were problems due to cap breakages and associated supply problems, and in Kenya SWAP initially had the same problem of cap breakages but these batches were recalled back by PSI and improvements were made. This was a serious problem because due to the chlorine leakage it was bleaching the clothes of the field officers and the bottles could not be sold. In Kenya, two other products (Pur and Aquatabs) were also available and promoted, along with safe storage containers. Treated water available for purchase at supply points was also part of the picture in Cameroon, either via the government (which was relatively expensive and was not wholly reliable), or more cheaply from the project (partly treated ground water which also required further point of use treatment). Treated supply has not, so far, been a feature of the Kenya work, although SWAP is planning to set up one treated supply point using river water.

#### *Household energy*

Both projects are using an unvented stove, which is designed to improve combustion, while in Cameroon fireless cookers were also promoted. The MMS in Cameroon uses all of the commonly available solid fuels in Mambanda (wood, sawdust and charcoal), while the Upesi is designed to use wood (and can also burn crop wastes such as sugar cane). The MMS is around three to four times more expensive than the Upesi. In both countries, users are very positive about the stoves, functionally to meet their needs, aesthetically, and in terms of reducing smoke and associated irritation and coughing. Unfortunately, only the Kenyan Upesi has been subjected to testing of HAP reduction and cooking efficiency (time to cook), although these tests show relatively little advantage over the traditional fires (further evaluation underway).

#### *Other products*

A key finding in both countries was that the mechanisms for promotion and sales included delivery of quite a wide range of products with potentially important impacts on priority health issues. Thus, in addition to the water treatment and stoves, both projects supplied products that included ITNs, condoms and soap (Cameroon), and ITNs, mosquito repellent,

condoms, contraceptive pills, soap, nutritional supplements (Sprinkles, fortified flour), antiseptic creams, diapers, and feminine hygiene products (Kenya). SWAP has most recently (2010) introduced *moringa oleifera* (a food supplement) and a solar lamp with a facility to charge phones, and soon expects to introduce ceramic filters through the partnership with PATH.

While in Cameroon, these other products were promoted and available via the shopkeepers (who were trained to give advice on use), in Kenya they were promoted alongside the water treatment and stoves by the vendors. This emphasises the potential of possibly further extending the health protection and promotion role of promotion and marketing activities such as these which are directed towards the home environment.

#### **4.3 Education and promotion**

There are important similarities between the projects in how products were promoted and sold, in particular the most successful aspects of this. The 'mami pegna' identity of the community workers in Cameroon, and the vendors in Kenya, had in common positive attributes of trust and good example. We are not able to determine which is the more successful, as the circumstances are so different, not whether specific features such as the branding of 'mami pegna' in Cameroon or the ETL method in Kenya are the more valuable, as this would require more focused research.

A second key issue common to both projects is that promotion combined both health messages and also messages on the practical and aesthetic benefits. Interestingly (and this was more clearly articulated in the Cameroon evaluation), while promotion of the stoves could combine messages on both of these aspects, for water treatment the messages were solely about health benefit because the product (particularly WaterGuard which was the sole product in Cameroon and the most common in Kenya) added work, had an unpleasant taste, and made no visible difference to the water. The situation is more mixed with PuR, as although it does make a dramatic difference to the appearance of water through flocculation ("the magic show"), use of the product is more involved and time-consuming. It is also possible that the water storage products in use in Kenya had aesthetic and practical appeal, although this was not explored, and not mentioned. The conclusion from this is that users of water treatment really must have taken on board the health arguments. It is interesting to speculate whether the combined delivery of products with a mix of health, practical and aesthetic benefits will lead to higher uptake of those products in the mix that rely for their regular use on acceptance of health benefits alone. Unfortunately, at this stage, we can only speculate on this.

#### **4.4 Selling of products**

Another important similarity is the commercial basis for sales, with neither project donating products. The Kenyan model of vendors as entrepreneurs, supported by low-cost loans, was different from that in Cameroon where subsidies were provided to consumers. In both countries, the products appeared to be priced at sensitive points, with sales improving during promotional periods where prices were reduced.

#### **4.5 Sustainability and scaling up, exit strategy**

There are some important and distinct differences between the countries in this important area. In Cameroon, an exit strategy was planned, in which the network of trained community workers, stove welders, shops, etc., would essentially be managed by a community committee, working with the local authority. This plan however appears to have been undermined by local political issues. The situation in Kenya is very different, in that SWAP is not currently planning to cease activities, and indeed would like to expand the integrated delivery of the water, stove and other products across their wider area of operations. There also seems to be considerable potential in Kenya for scaling up the approach used still further, although this does need further careful evaluation.

#### **4.6 Synergy**

A strong message from the experience of both projects is that combined promotion and sales of water treatment and stove products is beneficial in many ways. Rather than confusing or overwhelming users, it makes sense to them. It is more efficient in terms of training and promotion, although supply does need to be co-ordinated. There is some suggested evidence, at least from the data in Kenya, that combined use was associated with higher compliance with water-treatment, but this requires further analysis. These findings from both projects suggest that integrated delivery should be much more widely implemented, and this should be a key topic for the proposed follow-up workshop.

#### **4.7 Research and evaluation**

While some monitoring of sales of products was carried out in Cameroon, there is a much stronger research and evaluation framework in Kenya, on account of the NICHE project and collaboration with CDC. This experience emphasises the importance of planning thorough evaluation, particular when introducing innovations such as these, about which important questions of effectiveness and efficiency need to be answered.

## 5. RECOMMENDATION AND NEXT STEPS

### 5.1 Specific recommendations for countries

#### 5.1.1 Cameroon

As noted in section 2, project implementation in Cameroon ceased abruptly for a number of reasons. Given the circumstances, no clear exit strategy was put in place, and to our knowledge, the project has ceased to exist. There is no supporting institution left in place, the community organization has dissolved, and WG stocks depleted. The community has suffered as they can no longer enjoy the benefits they were encouraged to seek through the project. It is needless to say that the situation could be improved considerably. This would likely require more time, funding, and effort.

The major benefits of this synergistic approach are applicable to a range of environmental health interventions at the household level. The following are specific recommendations for improving and scaling the project in Mambanda. In order to expand activities, three major areas are:

- *Overall follow-up/project re-establishment*  
An assessment of the current situation, given the cessation of the project would be an appropriate first action. Initial tasks would include ascertaining which of the partner organizations are still operational, other available partners and the status of the former Mambanda water and sanitation committee.
- *Support for a local water, sanitation, and indoor air committee*  
Approaches to involve all stakeholders in a viable manner are required. For its duration, the community committee seems to have been successful. Given the household level of these interventions, such a model may still be appropriate. The active participation of the local government would also be a factor to include, together with other higher-level support.
- *Resource mobilization/financial mechanisms*  
Along with governance, finance is an important element to sustainability. Solutions to make the intervention business model profitable, reduce the upfront cost to the households, whilst maintaining incentive to local implementers/suppliers are crucial.

Specific assessments to further investigate the issues explored in Cameroon include:

- Compliance with WG, using measurements of chlorine residuals
- MMS uptake (including demographics of intervention households)
- Efficacy trials of MMS including emission, household air pollution levels and fuel efficiency, and possible alterations to its design if required.
- Health outcome studies for both WG and MMS users (with appropriate control groups)



## 5.1.2 Kenya

### *Household water treatment and storage*

- On compliance with HWTS, it will be important to conduct careful analysis to examine this stratified by socio-economic status, and for overall estimates to include adjustment for confounding: for example, those adopting both stoves and HWTS may differ from non/late adopters in a variety of ways.
- Develop a strategy for dealing with episodic handouts of water treatment products. This should include assessment of whether or not this can be prevented. It would be useful to document what education and advice is provided by the agencies concerned, at the time of the hand-outs, on use of these products.

### *Household Energy/reduction of indoor air pollution*

- Based on the results of the Upesi evaluation studies, other stove options should now be considered for scaling up, probably (for reasons of continuity) in addition to continued use of the Upesi – at least for the immediate future. Further advice should be sought (WHO can assist) on the question of how large a reduction in PM<sub>2.5</sub> will be deemed ‘acceptable’ for this purpose (see also general strategic recommendations, below). Any alternative stoves will need testing of both suitability (including affordability) and performance in terms of PM<sub>2.5</sub> reduction, and fuel efficiency.
- The team should obtain/calculate population-based data on uptake of the Upesi stoves, across the 10 villages of the integrated study area initially, but also make provision for assessing this across the whole NICHE study area. This should include information on purchase, and whether currently being used as the main/sole stove, or whether continuing to make substantial use of an open fire.
- There is a need, identified by the project, to develop additional production centres for Upesi stoves. This should be reviewed following completion of the PM<sub>2.5</sub> and fuel efficiency evaluation studies.
- [Subject to need] Provide advice to households on use of sugar cane in Upesi stoves.

### *Education, product supply and finance*

- Assess costs of training and providing the vendor service, and if possible carry out economic evaluation of the programme.
- Advocate for increased capacity of K-Rep (other organisation) to provide finance for vendor groups
- Carry out further assessment of vendor stocks and constraints on obtaining stocks, and if necessary identify ways to address any limitations.
- Keep pricing under review, and assess – with appropriate cautions - the possibility of arranging some form of targeted subsidy for poorer families. Investigate some form of ‘asset acquisition package’ for households
- [Unless already being done] Document education and product use in schools, and assess the impacts on behaviour, and if possible, health outcomes.

### *Sustainability and scaling-up*

- Given the apparently strong potential for scaling up the delivery methods used by SWAP, an option appraisal for scaling up should be developed involving, SWAP, other organisations/agencies, HENNET, and relevant government ministries.

### *Health outcome and impact assessment*

- The main study (and health outcome) analysis plan was not available to us during evaluation. Although this can be expected, it is important that analysis and interpretation of the impacts on interventions on health outcomes uses controlled comparisons where available, and adjusts for confounding factors as required.
- Assess the potential of extending the vendor role as a community health worker, with (potentially) responsibility for community case management. This raises issues of whether these individuals have sufficient basis education for the necessary training and skills development, and payment.

## **5.2 Strategic recommendations**

The experience from these two projects, in context of wider policy on addressing water and air quality, raises some general strategic questions for which recommendations are made.

The positive experience from these two projects concerning the apparent clear benefits of delivering HWTS and HHE interventions in an integrated way has important implications for future programmes. Specifically, the key strategic question is whether integrated delivery should be the norm, rather than, as at present, the exception and only seen in a very small number of innovative projects. This is a critical question for next steps with this work, and one of the principal justifications for holding a workshop to consolidate and critically assess experience from these two projects, and from other similar initiatives if these can be identified and involved.

In both countries, the situation in respect of safe water supply is very poor, and consequently HWTS clearly has an important part to play in public health policy. This point was clearly made by the WR (Kenya), Dr David Okello, not least due to the slow pace of progress in providing clean water supply even in urban areas, and the continuing high incidence of cholera. It would seem inevitable however, that very active promotion of HWTS could at the same time reduce the imperative to make substantive progress with the provision of safe, treated water supplies to communities and households. This tension could be addressed by setting plans for HWTS promotion in the context of clear and ambitious targets and timescales for treated water supply to the areas and communities concerned. If this linkage was the norm, progress with both point of use and community treated supplies, could be assessed together. In considering this, it is important to keep in mind that achieving high rates of routine compliance with HWTS appears to be very difficult.

Identifying, implementing and scaling up household energy interventions that are highly effective in terms of reducing HAP levels and exposure, and are affordable and practical for the large numbers of poor homes most affected by this issue, remains a challenge. This is highlighted by the current project (specifically in Kenya where PM2.5 reduction data are

available), but it has been a common experience. If this matter is not to be a serious barrier to progress in many less developed countries, it is important to consider adopting, as mainstream policy, a phased approach to achieving reductions in HAP. In this scenario, initial interventions would, in addition to being affordable, safer, more fuel efficient and well-liked by users, also provide quite substantial but not necessarily optimal exposure reduction. Optimal exposure reductions will be defined by air quality guidelines (see below). Based on the repeated evaluation of the Upesi stove in Kenya, reduction in 48-hr kitchen PM<sub>2.5</sub> concentrations is around 10-20% at best, which may not be sufficient for useful health benefits - this will however be the topic for further consideration and expert advice. Unfortunately, to date, the HAP reduction with the MMS stove in Cameroon has not been studied, and this should be done as soon as possible. There is some encouragement for this pragmatic, phased approach from the exposure-response analysis from the RESPIRE trial in Guatemala, which shows that a 50% reduction in exposure resulted in a useful reduction in child ALRI risk, even though residual exposure levels are still high in comparison with WHO air quality guidelines (AQGs) (Smith, K et al., 2011). With this approach, however, it must be stressed that on ethical and equity grounds, the standard sought and longer-term target must be the same (low) levels for all, and that these targets must be derived by reference to WHO indoor AQGs.

### **5.3 Follow-up workshop**

The evaluation plans for the projects included the option of a follow-up workshop, with resources to support this. This would be very valuable for reflecting on the experience reported here, and planning a longer-term strategy to promote and evaluate the combined delivery of environmental health interventions at the household level. This proposal had the support of Dr David Okello/Kenya, who agreed to help support the organisation of a meeting if this were to take place in Kenya. Planning for this workshop will be carried out following consultation based on this report.

### **5.4 Issues for further research**

The following areas for further research are proposed. The follow-up workshop will provide a good opportunity to identify and prioritise requirements for further research, and the preparation phase should include further consultation on these questions.

1. In what situations are integrated approaches more or less suitable? Should integrated delivery be the norm, or restricted to special situations? Are there particular advantages in areas with highly stressed fuel and/or water supplies, or where climate change adaptation will be especially demanding?
2. What types of interventions (including specific products where appropriate to specify these) are most appropriate for integrated delivery? Are there other interventions in the household setting aimed at priority health issues, not considered by these projects, which should be included?
3. What is the role of the health system in co-ordinating, managing and delivering integrated programmes for improving the household environment, given the multi-sectoral nature of the problems and the frequent involvement of NGOs, and other agencies/donors?
4. What are the most effective models for integrated delivery, including consideration of the role of local market systems, and involvement of communities and users?

5. What financing arrangements, e.g. loans, subsidies, etc., are needed to support (i) delivery and (ii) users, and what approaches to managing these are most effective? These questions may not differ from similar questions for other examples of delivering products and services in poor communities, although the need to supply and adopt a combination of products might raise different issues.
6. What additional issues for scaling up need to be considered for integrated approaches, over and above those pertaining to scaling up of other community health and development projects and programmes?
7. Does integrated delivery result in greater effectiveness, and economic efficiency, in respect of (i) compliance and (ii) health impacts, as compared to delivering similar interventions through separate programmes? What research methods and studies designs will be most appropriate? See further discussion of this below.

### **Issues in evaluating the added value of integrated interventions**

The assessment of whether or not ‘synergies’ from the integrated delivery bring ‘added value’ in terms of health impacts (and the inputs, process and outputs that ultimately lead to health impacts), is complex. Robust quantification of added value for health outcomes – true ‘interactions’ resulting from the benefits of reducing diarrhoea and respiratory (and potentially other, e.g. malaria) morbidity at the same time – would be very complex and expensive, and likely require some form of factorial study designs that very significantly distort delivery mechanisms and hence may have little relevance to actual effectiveness. A more efficient and practical approach may be to thoroughly assess process (efficiency, benefits to supply, business opportunities, users perspectives, etc.), as well as compliance with the interventions, and overall changes in morbidity rates. These options require careful evaluation.

### **5.5 Future implementation**

The workshop will provide the opportunity for planning future work. A joint set of web pages on integrated approaches, including this report and supporting documentation, would be a useful resource. In addition to project reports (which are likely to remain internal), scientific publications will be available in due course from the NICHE/SWAP project in Kenya. It would be valuable in the meantime to build on the experience of these projects, this evaluation, and the background paper by Clasen and Biran, to prepare a publication to raise awareness of potential benefits of integrated delivery, experience to date, and future directions for policy and research. This should be planned in collaboration with SWAP and CDC for Kenya, and with GTZ in Cameroon.

### ***National policy framework***

Consideration needs to be given to how innovation in and adoption of integrated approaches to household environmental risk relates to national policy. This will include the formulation of new policies, the adjustment of existing policies and the harmonization of policies in different sectors. This could also be usefully linked to household horticultural water use for food security. The whole range of environmental health and nutrition interventions at the household level should be covered by such a policy framework, and lead to national guidelines for certification and quality control as well.

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## ANNEX 1 Visit schedule (December 2009)

Date	Ameer Shaheed	Nigel Bruce
10	Travel Geneva-Douala	
11	Evaluation field work	
12	Evaluation field work	
13	Evaluation field work	Travel UK → Nairobi
14	Depart Douala → Nairobi	Brief WR (Nairobi); Travel to Kisumu
15	Arrive Nairobi → Kisumu Evaluation field work	Planning review meeting Evaluation field work
16	Evaluation field work	Evaluation field work
17	Evaluation field work; wrap-up meetings	Evaluation field work; wrap-up meetings
18	Travel → Nairobi; brief WR	Travel → Nairobi; brief WR; Depart
19	Post-field note-taking and drafting outline of report	Arrive UK

**ANNEX 2** Evaluation topics/questions

<b>Project staff/agencies</b>	<b>Community members/Households</b>
<p><b>Introductory information</b>            Role in the project</p> <ul style="list-style-type: none"> <li>• Responsibilities</li> </ul>	<p><b>Introductory information</b>            Family information</p> <ul style="list-style-type: none"> <li>• Age, sex, marital status, household size</li> </ul> <p>Education            Employment status</p>
<p><b>Experience with the project</b>            Water treatment (+ and – aspects)</p> <ul style="list-style-type: none"> <li>• Cost</li> <li>• Availability</li> <li>• Ease of use</li> <li>• Other</li> </ul> <p>Improved stove and fuel(+ and – aspects)</p> <ul style="list-style-type: none"> <li>• Cost</li> <li>• Availability</li> <li>• Ease of use</li> <li>• Other</li> </ul> <p><b>Financial assistance</b>            What arrangements are you aware of?</p> <ul style="list-style-type: none"> <li>• (+ and – aspects)</li> </ul>	<p><b>Water Sources and Treatment</b></p> <p>From where do you obtain water for the household?</p> <ul style="list-style-type: none"> <li>• Wet vs. dry season?</li> </ul> <p>Did you consider the water you collected prior to the project safe?</p> <p>Did you treat your water prior to the project? How?</p> <ul style="list-style-type: none"> <li>• Wet vs. dry season?</li> </ul> <p>Since the project started, have you changed water sources?</p> <p>Since the project started, do you treat your water? How?</p> <ul style="list-style-type: none"> <li>• Wet vs. dry season?</li> </ul>
<p><b>Views on project synergies</b>            Open ended questions drawing out positive and negative aspects</p>	<p><b>Household Energy</b>            Prior to the project, what fuel(s) did you use?</p> <ul style="list-style-type: none"> <li>• Wet vs. dry season?</li> </ul> <p>Has your fuel use changed since the onset of the project? If so how?</p> <ul style="list-style-type: none"> <li>• Wet vs. dry season?</li> </ul>
<p><b>Improvements/further benefits</b>            How may the project have benefitted further?</p> <ul style="list-style-type: none"> <li>• Management</li> <li>• Products</li> <li>• Educations</li> <li>• Promotion</li> <li>• Finance</li> <li>• Supply and distribution</li> <li>• Evaluation</li> <li>• Other...</li> </ul>	<p><b>State your reasons for:</b>            Using water treatment only            Using the improved stove only            Using both            Using neither</p>