POLICY BRIEF

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Biosand Filter: An Eco-efficient Household Water Treatment Technology and a Viable Eco-business Option

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Executive Summary

A Biosand filter basically applies a system of sand, gravels and biologically active micro-organisms to remove unwanted substances from drinking water. Field trials of the biosand filter for domestic water treatment in rural communities have shown remarkable health gains. In line with this, there are calls to scale up its application in developing countries.

This study investigated factors that may influence the acceptability of the biosand filter at the household level in rural communities in Ghana. The study further applied lifecycle environmental and cost assessments to analyse the eco-efficiency potential of the biosand filter and examined prospects of leveraging this potential for green business development. The key demographic and socio-economic indicators of biosand filter acceptability were gender, age, education and wealth. Females showed greater interest in the biosand filter, while increase in age, relative advancement in education and economic status of respondents increased the prospects of purchasing biosand filter. Compared to local sachet water production, which was considered as an alternative to household application of the biosand filter, it was established that the latter had superior eco-efficiency, provided quite comparable profitability and was potentially viable for eco-business development.

Context and Importance of the Problem

Sustainable management of water positively affects the wellbeing of individuals and communities, and would stimulate green growth. Unfortunately, there are water management challenges confronting the world today. The worst affected are rural communities in developing countries. According to the World Health Organisation (WHO), 1.1 billion people lack access to safe drinking water in the developing world (WHO, 2004). Lack of access to clean water and adequate sanitation cause approximately 1.8 million deaths each year from diarrhoea

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and other water and sanitation related diseases, with 90% of the mortality occurring in children under five years. It has been estimated that improved water supply could reduce diarrhoea morbidity by 21%, improved sanitation could reduce diarrhoea morbidity by 37.5%, but improvement in drinking water quality through point-of-use (POU) water treatments, could reduce diarrhoea episodes by as much as 45% (WHO, 2004).

Biosand filters are perhaps one of the most promising low cost technologies for POU water treatments. For its potential to be fully realised, it must be culturally accepted and available to rural folks on a sustainable basis.
The key questions then are:
I) Would rural households accept the biosand filter, and;
II) Would the biosand filter be competitive and attractive as a local green business venture?

It is against this background that this research evaluated the acceptability of the biosand filter in rural communities in Ghana and assessed its potential for eco-business development.

Key Findings

Acceptability of the biosand filter
A survey was conducted in selected villages in the Offinso and Ejura districts in the Ashanti Region of Ghana and Bongo district of the Upper East Region of Ghana. A sample size of 150 households was used. The results revealed that 51% of the respondents sourced their drinking water directly from rivers and streams, 43% from boreholes and wells, while 6% purchased sachet water. Thus, nearly half of the respondents lacked access to improved water supply.

Nonetheless, only 18% reported any form of domestic water treatment. For majority of the respondents (82%) who did not apply any form of treatment to drinking water, cultural reasons (37%) as well as cost / difficulty (31%) of treatment were given as the main reasons that discouraged point-of-use (POU) water treatments. 19% of the respondents on the other hand were not aware of such treatments.

The key demographic and socio-economic indicators of biosand filter acceptability were gender, age, education and wealth. Females were more inclined to accept the biosand filter. This is consistent with cultural practices in Ghana where domestic water issues are mostly handled by women. Also, biosand filter acceptability may improve with advancement in age and education of individuals. Persons who were relatively wealthy or in good socio-economic standing in the villages may also accept the biosand filter more readily.

Eco-business potential of the biosand filter
The parameters considered in estimating eco-business potential are utility value, lifecycle environmental load and lifecycle cost. The lifecycle environmental load and cost were each normalised to a functional unit of 1 m^3, i.e. the load and cost associated with 1 m^3 of treated water. The environmental loads were also weighted applying the ecological scarcity method (Federal Office of the Environment – Switzerland, 2013).

As compared to sachet water production, which was the highest alternative with respect to drinking water provision in many Ghanaian households, there is a high environmental load from sachet water, especially at the use phase of the product, as a result of the huge volumes of plastic waste generated from using the product. The distribution phase of the sachet water also generates considerable environmental load because of vehicular emissions during the transport of these products.

In the case of the biosand filter, the major environmental loads are attributable to the extraction of sand and gravels used in producing the filter, as well as water applied to wash these inputs. Taking into consideration the utility value of the biosand filtered water, which was estimated in terms of economic value of the highest alternative (that is, sachet water), and given the lifecycle environmental loads and costs of biosand and sachet water treatments (Figures 1 and 2 below), the biosand filter was deduced to provide greater eco-efficiency.

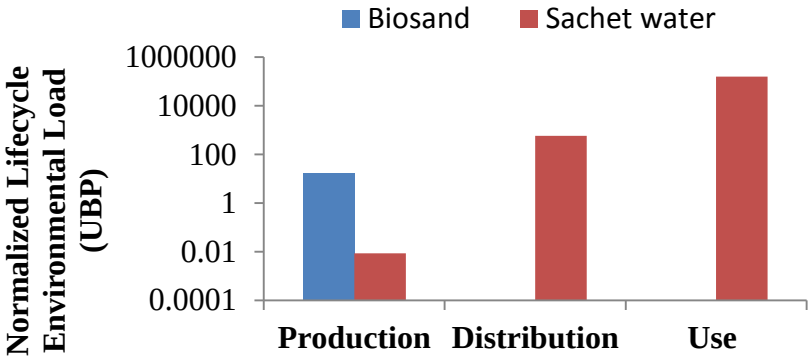

Figure 1: Lifecycle environmental load associated with the treatment of 1m^3 of water over a period of one year for biosand and sachet water systems. The environmental load is expressed in UBP – the reference unit for ecological scarcity method (Federal Office of the Environment – Switzerland, 2013).

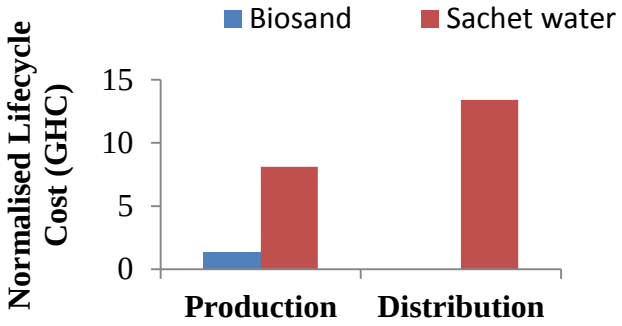

Figure 2: Lifecycle cost associated with the treatment of 1m^3 of water over a period of one year for biosand and sachet water systems.

Profitability analysis suggested that biosand filter production is profitable, although its profit margin, (GHC 187,318.9), was slightly lower (by a factor of approximately 1.2) than that of sachet water production (GHC 218,068.5) in five-year projections (Table 1 below). Compared to sachet water production, it was established that the biosand filter had superior eco-efficiency and provided appreciable profitability as a rural enterprise. The fact that the biosand filter is ecologically efficient and potentially profitable means that it could be produced and pursued as a green business venture, which is desirable in a green economy.

Table 1: Five-year projections of profit margins of biosand filter and sachet water production.

	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Total (5 Years)
Biosand Filter (BSF)						
Unit price (GHC)*	120	126	132.3	138.92	145.86	
Number of units produced	1000	1000	1000	1000	1000	
Estimated revenue (GHC)	120000	126000	132300	138915	145860.75	663075.8
Life cycle cost (GHC)	86100	90405	94925.25	99671.51	104655.1	475756.9
Profit (GHC)	*33900*	*35595*	*37374.75*	*39243.49*	*41205.65*	*187318.9*
Sachet Water (SW)						
Unit price (GHC)*	0.0150	0.0158	0.0165	0.0174	0.0182	
Number of units produced	7488000	7488000	7488000	7488000	7488000	
Estimated revenue (GHC)	112320	118310.4	123552	130291.2	136281.6	620755.2
Life cycle cost (GHC)	80173.46	79523.9	79773.49	80780.91	82434.92	402686.7
Profit (GHC)	*32146.54*	*38786.5*	*43778.51*	*49510.29*	*53846.68*	*218068.5*

**Price projections for 2015 onwards were estimated as 5% increment on the previous year's price. The estimated profit is before tax.*

Policy Considerations

The following policy suggestions are intended to help scale up household water treatment in Ghana and build up local interest in the biosand filter:

Community Sensitisation

Considering the fact that cultural reasons emerged quite strongly for not applying any household water treatment, and also given the fact that acceptability of the biosand filter increased with education, it is essential that education is used as a tool to lessen cultural hindrances and facilitate behavioural change for the application of household water treatment methods. Education on household water treatment and storage could be included in community health outreach programmes, especially in districts that lack improved access to drinking water.

Investment in the Production of Biosand Filters

Small scale business enterprises should be encouraged to invest in the production of biosand filter. This is because this can be a profitable venture, in addition to the ecological incentive and health benefits it provides. The government could create an enabling environment for such small green businesses to thrive, for instance, by providing tax exemptions as well as access to credit to facilitate the establishment of these businesses.

Maximised Usage for Urban Dwellers

It is recommended that the potential of the biosand filter should be maximised not only for rural communities but also for urban communities as well. The biosand filter will be useful, especially for those living in urban slums that lack potable drinking water. The recent cholera outbreak in Ghana with over 17000 reported cases and 150 deaths, which occurred mostly in urban areas, provides clear basis that such household water treatment methods are equally relevant for urban communities.

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