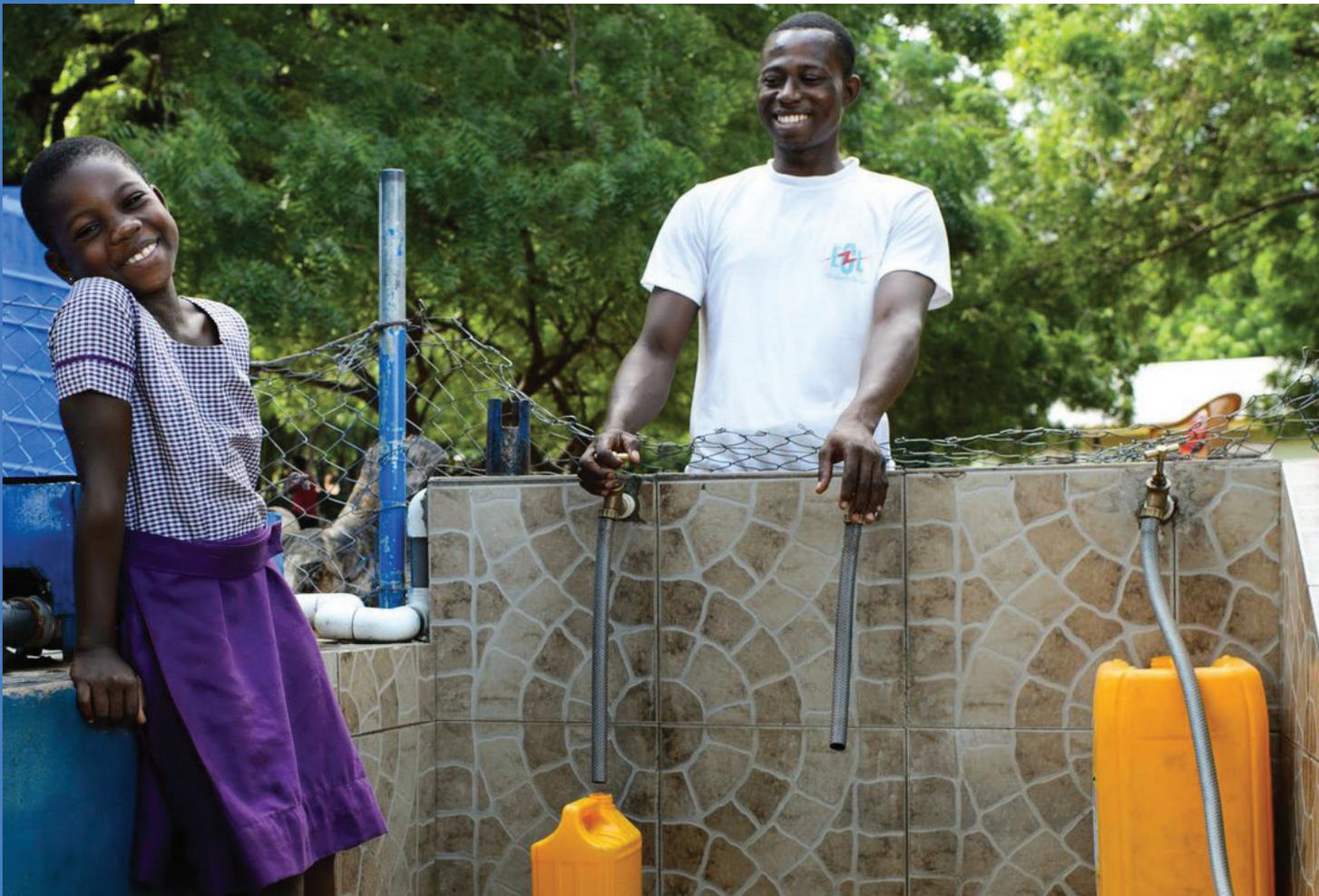


**MARCH 2015**

# A CLUSTER APPROACH TO LOCALLY OWNED AND OPERATED SAFE WATER STATIONS: EXPERIENCE & PUBLIC-PRIVATE PARTNERSHIP OPPORTUNITY IN GHANA



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## **About Safe Water Network**

Safe Water Network's priority is to demonstrate at credible scale the success of locally owned and operated community water stations that deliver safe, affordable, and reliable water to populations in need. We prioritize achieving a balance between financial viability of the water Station and equitable, affordable access for the local population. We continuously improve and expand our model with the intent of broad replication within the sector. Our operating footprint provides the basis for mobilizing partnerships as well as documenting and sharing our efforts through forums, workshops, reports, and case studies. To date, we have implemented more than 100 Safe Water Stations, providing safe water access to more than 400,000 people in Ghana and India. Safe Water Network was co-founded in 2006 by actor and philanthropist Paul Newman, along with prominent civic and business leaders.

## INTRODUCTION

This note offers context to Ghana's public-private partnership (PPP) environment and infrastructure situation, and presents a prospective case study illustrating the potential of structuring a PPP around a cluster of water stations in rural communities and small towns in Ghana. The preliminary financial analysis will assist us in understanding the incentives to public and private sectors as a means to achieving local sustainability for community water systems.





## Context: Public-Private Partnerships and Infrastructure in Ghana

The Ghana *National Policy on PPPs* was approved by the Cabinet in June 2011 to encourage the use of PPPs as a means of leveraging public- and private-sector resources and expertise to close the infrastructure gap and deliver efficient public infrastructure and services.<sup>1</sup> The Ministry of Finance and Economic Planning leads PPP development in Ghana through its Public Investment Division. Projects under the national PPP program are selected from sectors that have been identified within the National Infrastructure Plan,<sup>1</sup> including water, waste management, and flood control.

The 2010 *Africa Infrastructure Country Diagnostic* reports that Ghana stands out as having an advanced infrastructure platform when compared with other low-income countries in Africa.<sup>2</sup> It boasts a substantial volume of water storage by African standards and significant improvement in utility finances but continues to struggle with the reliability of water and power supply. Addressing all of Ghana's infrastructure challenges, including water, will require sustained expenditure of almost \$2.3 billion per year over the next decade, split between investment and operations, and maintenance. The report states that raising the country's infrastructure endowment to that of the region's middle-income countries could boost annual growth by more than 2.7 percentage points. Infrastructure contributed just over one percentage point to Ghana's improved per capita growth performance during the 2000's.

The Parliament of Ghana endorsed the Ghana Infrastructure Investment Fund bill in July 2014, and in February 2015, President John Dramani Mahama set up a nine-member board of directors and a five-member advisory committee. The board will advise the Minister of Finance on viable projects to be financed by the fund, including those involving joint ventures and PPP projects.

The government of Ghana has clearly prioritized PPPs to implement national infrastructure plans, providing a timely opportunity for stakeholders along the value chain to advance partnerships for community water provision.

“Given limited budget resources, the country's huge deficit in infrastructure cannot be met by the public sector alone through budget allocations.”

— Hon. Seth Terkper  
Ministry of Finance. (2014).  
Ghana Public Private Partnership Programme  
Newsletter, Issue 1.



<sup>1</sup> Government of Ghana. (2011). *National Policy on PPPs*.

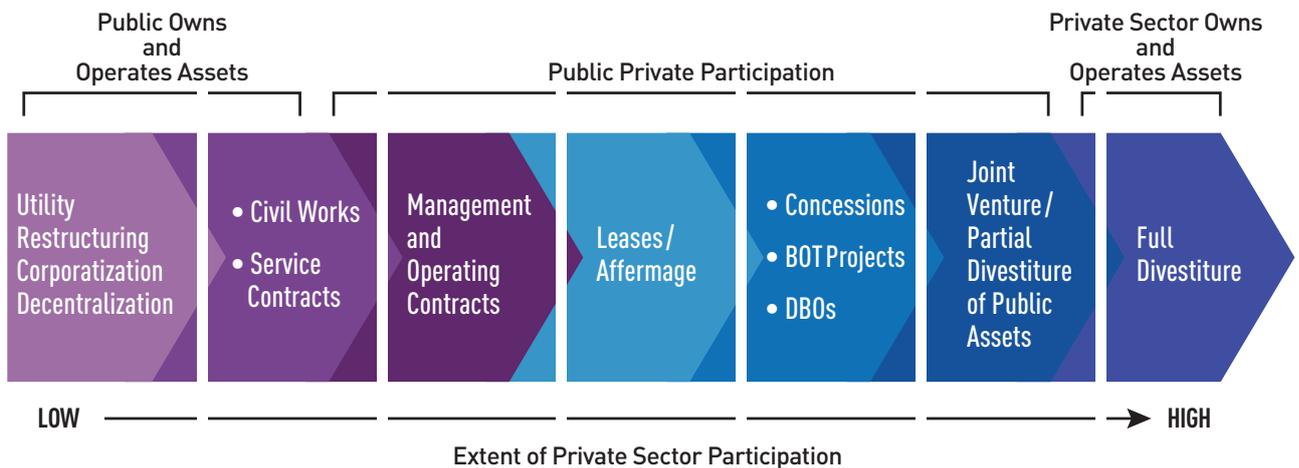
<sup>2</sup> International Bank for Reconstruction and Development/The World Bank. (2010). *Ghana's Infrastructure: A Continental Perspective*. <http://www.infrastructureafrica.org/system/files/library/2011/07/CR%20Ghana.pdf>

## Defining Public-Private Partnership Opportunities

The private sector could be engaged in various capacities along the PPP spectrum (see Figure A below), including service contracts for operation and maintenance carrying relatively low risk. There may be potential for higher levels of private-sector engagement, such as leases and affermage, through which the private operator is responsible for operating and maintaining the utility; this differs from a service contract in that the operator does not receive a fixed

fee but charges an operator fee to consumers and also tends to employ staff directly. The private sector could also leverage public-sector investment and invest capital in a substation or subset of improvement projects, such as household connections or increasing storage capacity. The private sector takes on more responsibility and risk through arrangements further down the spectrum including Build-Operate-Transfer and Design-Build-Operate.

**FIGURE A.** Types of Public-Private Partnership Agreements (Source: World Bank)  
 BOT = Build-Operate-Transfer; DBO = Design-Build-Operate



## Advancing Public-Private Partnerships for Community Water Provision in Ghana

According to Safe Water Network's preliminary analysis, opportunities for PPPs exist in rural communities and small towns in Ghana. Preliminary review by Safe Water Network suggests that the addressable market<sup>3</sup> would lend itself to 409 water stations (and 697 substations) to serve 1,100 communities comprising 3.4 million people, which would reach 22 percent of the population in rural communities and small towns in Ghana; the remaining market either already has water coverage greater than 50 percent or would need to be served by alternate approaches that include ongoing subsidies or lower-cost models. The cost for covering the addressable market in Ghana is estimated at GHS 205 million (US\$68 million).

The involvement of private companies in Ghana's water sector has to date been limited. Assets are either publicly or community owned and are largely managed by communities themselves. It is estimated that there are some 300+ piped water systems, serving nearly 200,000+ people and currently being managed by Water and Sanitation Management Committees, which could potentially have been managed in partnership with the private sector. Only eight (some two percent) are managed in partnership with the private sector, of which six are successfully functioning.

Public and private sectors have a vested interest in community water supply throughout the value chain. PPP opportunities for the public sector lie in a cost-effective approach to providing access to safe and affordable water sustainably. The government of Ghana, working through the Ministries of Water Resources, Works, and Housing (MWRWH) and of Local Government and Rural Development (MLGRD), is responsible for the provision of water supply and sanitation services respectively. Water supply services are delivered under the aegis of the Community Water and Sanitation Agency (CWSA) in rural communities and small towns and the Ghana Water Company Ltd. (GWCL) in urban areas. The government of Ghana reports rural coverage at 64 percent and urban coverage at 63 percent in 2012<sup>4</sup> and has a long-term vision in water provision that is to guarantee universal access by 2025.

*The next section presents a proposition for private-sector engagement for an area comprising 10 districts across the Volta and Eastern regions.*



<sup>3</sup> The addressable market includes all communities targeted by the Community Water and Sanitation Agency with coverage of water supply of less than 50 percent and includes assumptions around geographical proximity of these communities.

<sup>4</sup> Government of Ghana. Government Achievements and Interventions in Water Supply.



# A CLUSTER APPROACH TO LOCALLY OWNED AND OPERATED SAFE WATER STATIONS: EXPERIENCE AND PUBLIC-PRIVATE PARTNERSHIP OPPORTUNITY IN GHANA

This prospective case study from the Lower Volta Cluster reviews preliminary analysis to illustrate the potential of structuring a Public-Private Partnership (PPP) around a cluster of water stations in rural communities and small towns in Ghana. The analysis focuses on the potential for a cluster approach to serve the population of Ghana's rural communities and small towns with an inclusive, financially sustainable program. It builds on Safe Water Network's experience implementing locally owned and operated Safe Water Stations, and insights and data from sector stakeholders, including ministries, government agencies, and other organizations, for private-sector participation in market-based community water solutions.

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## Public-Private Partnership Proposition Overview

A cluster of locally owned and operated, self-sufficient water stations with technical support services offers beneficial opportunities to the public and private sectors.<sup>5</sup> Opportunities for the public sector lie in a cost-effective approach to sustainably providing access to safe and affordable water. For the private sector, there are economic incentives in rural communities and small towns for service and management contracts, and to upgrade and expand beyond initial capital expenditure. (See Annex 1 for information on the value chain.)



<sup>5</sup> Based on initial assessment of Safe Water Network's Stations and estimates.

## 1 | Financial Sustainability Within a Cluster

### i. Market Sizing:

Communities are divided into distinct groups (Table 1) based on their size to estimate an addressable market size for stations to be financially sustainable. Groups and population thresholds have been determined using assumptions around various factors: consumption, household penetration, price, and water system efficiency.

If each Station were to serve one community, only communities in groups A, B, and C (population >3,312) would be large enough for a station to be financially sustainable; however, our water systems also include a piped network of substations that serve multiple communities located close to each other. Therefore, our addressable market size includes the larger communities (A, B, and C) along with a percentage of smaller communities (D), which we assume are proximal to the larger communities to be included in the service area of a station. (Refer to Page 10.)

**Table 1.** Categorization of population per service area

GROUP	POPULATION PER SERVICE AREA <sup>6</sup>
A	9,405+
B	4,335 - 9,404
C	3,312 - 4,334
D	<3,312

### ii. Technical Support Services:

To be financially sustainable, a water station also needs to generate adequate cash flows to pay for external support for technical issues such as breakdowns, minor replacements, etc. In Ghana, Safe Water Network is establishing a Field Services Entity (FSE), an independent organization that will provide operation and maintenance servicing to clusters of Stations. The FSE's costs<sup>7</sup> will be fully covered by stations using revenues generated from water sales.



### iii. Maintenance Reserve:

A station also needs to accrue part of its free cash flows as a reserve for replacing the major components of the equipment over their life spans.

### iv. Start-Up Capital Recovery:

Any balance of profits after paying the FSE and accruing toward a maintenance reserve is used to repay the initial investment.

<sup>6</sup> Service area is defined as the geographical area, including single or multiple communities, whose population is served by a water station.

<sup>7</sup> We are currently developing a financial model for costs and revenues of the Field Services Entity (FSE). Based on our current estimates, a station needs to pay the FSE GHS 9,000 or US\$3,000 annually in year 1. This incorporates a 30 percent margin paid to the FSE, making it an attractive business proposition.

## 2 | Analysis of the Four Existing Stations in Lower Volta Cluster

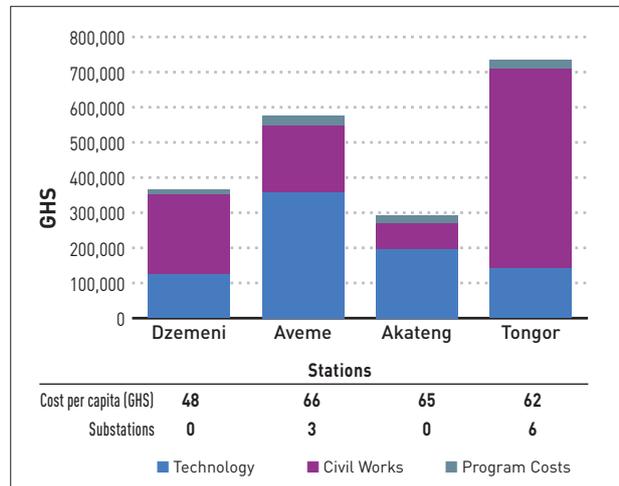
### i. Start-Up Capital Expenditure

As of 2014, we have invested a total of GHS 2 million (US\$656,000)<sup>8</sup> in four Stations in the Lower Volta Cluster. (See Annex 2 for maps of locations and Station treatment and distribution processes.) The major components of capital expenditure include:

- Water treatment system (technology)<sup>9</sup>
- Piping, storage, and housing facility (civil works)<sup>10</sup>
- Village assessments, consumer activation, ongoing field support, etc. (program costs)

Capital cost per capita in Figure B includes the cost for main Stations and Substations.

**Figure B:** A total of GHS 2 million (US\$656,000) has been spent on establishing the four existing Stations in the Lower Volta Cluster.<sup>11</sup>



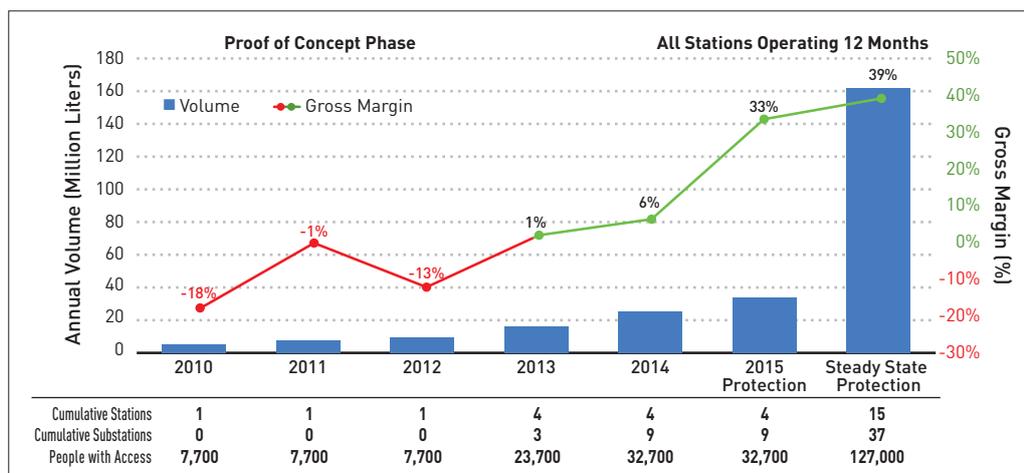
### ii. Financial Performance

We started operations in this region with one Station in Dzemeni serving 7,700 people. In 2013, we added three new Stations in Aveme, Akateng, and Tongor, which increased volumes by significantly growing our reach from 7,700 to 23,700 people.

Figure C shows volumes and gross margins of the existing Stations in the Lower Volta Cluster from 2010–2014 and projections for the year 2015. The gross margins are derived after the reduction of direct operating costs,

which comprise slightly higher fixed costs (56 percent) when compared to variable costs (44 percent). This gives the model slim operating leverage to drive financial performance through growth in volumes. Our gross margin therefore grew from negative margins in 2010–12 to 6 percent in 2014. We expect a higher gross margin in 2015 primarily due to improved financial performance as a result of new Substations coming on line at the end of 2014 and lower operating costs of a new technology<sup>12</sup> being implemented at the Dzemeni Station.

**Figure C:** Financial performance of existing and projected Stations indicates an improvement over time due to increase in volumes and market size.



<sup>8</sup> Conversion rate of 3 GHS = 1 USD.

<sup>9</sup> Technology costs in Aveme are higher due to installation of a solar panel in addition to the electric grid.

<sup>10</sup> The cost for civil works for stations varies depending on the size of the population served (e.g., Dzemeni has a larger population than Akateng).

<sup>11</sup> Capital expenditure for Dzemeni includes the cost of planned expansion in 2015. We have considered the prior investment in 2009 to be a sunk cost.

<sup>12</sup> The technology at Dzemeni is being switched from ultraviolet to modular slow sand filtration (MSSF) to lower operating costs. The capital cost for this switch has been included in Figure B.

### 3 | Fully Developed Cluster

The prospective fully developed cluster comprises 15 stations and 37 substations (Figure C) to serve around 127,000 people in 52 communities (an estimate based on the market-sizing exercise described in Section 3(i)). The average capital expense per station is around GHS 500,000 (US\$164,000), which means a total capital cost of GHS 7.4 million (US\$2.5 million) for this cluster with a per capita capex of GHS 60 (US\$20).

To develop the financials for this cluster, we considered the actual costs and price for 2014 as reported by our existing stations. Volume is projected using the estimated market size (Section 3(i)) and assumptions on household penetration and consumption per capita per day. Our preliminary analysis indicates that the operating margin of the cluster is higher than our existing stations due to a larger market size, resulting in higher volumes sold.

#### i. Market Sizing<sup>13</sup>

The market size for this cluster is estimated based on the data set obtained from the Community Water and Sanitation Agency in Ghana and assumptions around the proportion of communities we can serve given the existing water coverage and the location of these communities. Initial findings indicated that the total market size for a fully developed cluster includes 52 communities comprising 127,000 people. This results in serving 4 percent of communities and 15 percent of the total population in the Lower Volta Cluster.

**TABLE 2** Market size in the Lower Volta Cluster

	COMMUNITY			POPULATION		
	LOWER VOLTA CLUSTER	% SERVED <sup>13</sup>	NUMBER SERVED	LOWER VOLTA CLUSTER	% SERVED <sup>13</sup>	NUMBER SERVED
A (>9,405)	2	0%	-	29,181	0%	-
B (4,335-9,404)	15	33%	5	86,075	28%	24,101
C (3,312-4,334)	14	43%	6	52,839	52%	27,476
D (2,300-3,311)	34	29%	10	91,785	28%	25,700
E (1,300-2,299)	96	24%	23	164,879	25%	41,220
F (900-1,299)	35	24%	8	36,661	23%	8,432.03
G (<900)	1,269	0%	-	410,076	0%	-
<b>Total</b>	<b>1,465</b>	<b>4%</b>	<b>52</b>	<b>871,496</b>	<b>15%</b>	<b>126,929</b>

Source of Raw Data: Community Water and Sanitation Agency, Ghana.

<sup>13</sup> This market size is estimated based on assumptions around geographical proximity of these communities and excludes communities that already have more than 50 percent water coverage. On implementation, the actual market size could vary, which would also affect the current cluster size of 15 stations.

## 4 | Drivers of Financial Performance

### i. Pricing

We need to conduct further analyses to understand price elasticity in detail and particularly focus on inclusiveness and understanding the proportion of the lower socioeconomic segment we would lose as customers if we raise prices.

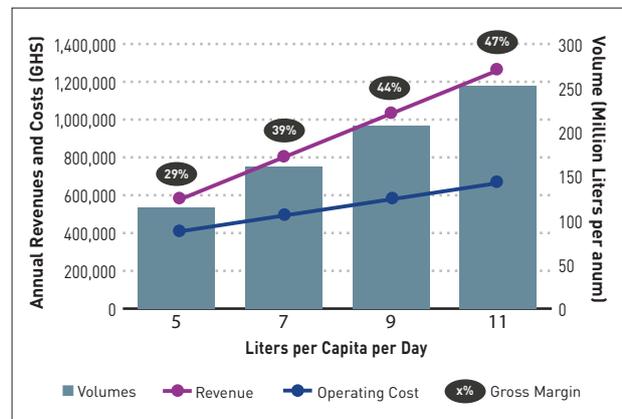
### ii. Consumption

The primary unit to measure consumption is liters per capita per day. According to WHO standards, a minimum of 7.5 liters per capita per day will meet the requirements of most people under most conditions. We analyzed the impact of consumption as a driver of cluster financial performance by considering four scenarios, starting at 5 liters, each with an increase of two liters of consumption per capita per day at



the current price (GHS 0.10) and constant household penetration. Results, as seen in Figure D, indicate that revenues grow at a faster pace than do costs, leading to higher profits from increases in consumption. This is because while variable costs increase with higher volumes being sold, the fixed cost on an average per station remains the same, resulting in improved margins.

**Figure D:** Increase in per capita/day consumption and resulting volumes improves gross margins as revenues grow faster than costs.



## 5 | Opportunities for Private-Sector Engagement

There are immediate opportunities for private-sector engagement in the Lower Volta Cluster with service contracts and anticipated opportunities for improvement projects.

### i. Operation and Maintenance

Each water system requires operation and maintenance (from an FSE) (mentioned in Section 1), a service that can be more cost-effective at cluster level than at station level. The fully developed Lower Volta Cluster and even the four current Stations can support service contracts in which the public sector contracts the private sector to provide operation and maintenance to the water systems. The financial performance in Figure C accounts for a service fee and salary for an FSE, which still leaves a six percent gross margin in 2014 and 39 percent at a cluster level.

### ii. Investment in a Substation

Capital investment in a water station also includes the cost of substations, which are built to reach additional communities proximate to the community where the main station is located. On average, building a substation costs GHS 55,700 (US\$17,400) versus GHS 366,000 (US\$122,000)<sup>14</sup> for a main station, including additional storage and piping. Investment in a substation therefore leverages the prior investment in the main station to provide greater access at a lower cost with capex per capita reduced by more than 50 percent, from GHS 146 (US\$49) to GHS 70 (US\$23). Projected financials for a standalone substation are presented below in Figure E, indicating that the entire

capital cost could be recovered in six years (after using the gross profit to create a maintenance reserve).

### iii. Investment in Expansion/Improvements

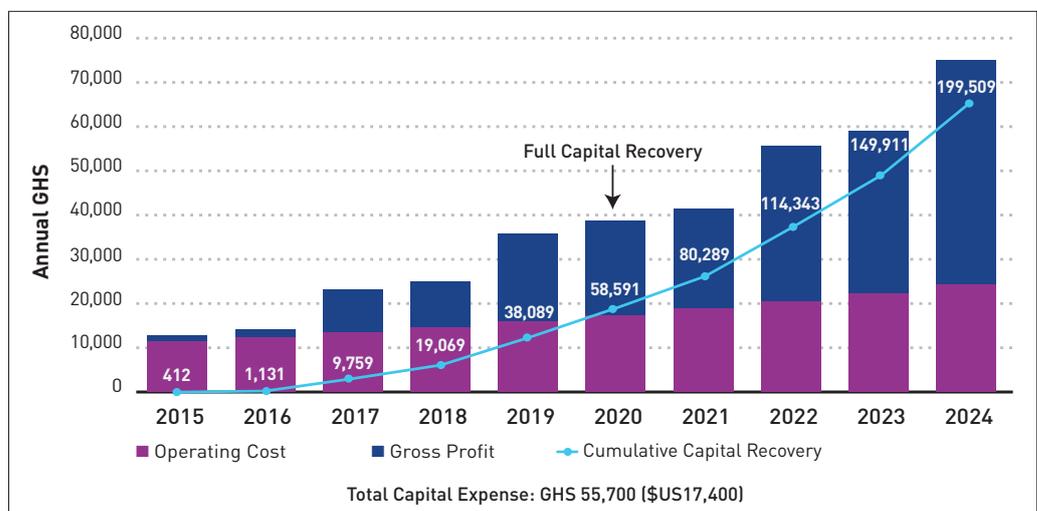
Investment could also be made in improving the current technology/treatment system or expanding capacity. For instance, to improve reach or penetration, a water station may require an additional storage tank or bore well. Investment could be made in each of these components and resulting improvement in profitability (due to higher volumes/cost efficiencies) could drive capital repayment.

### iv. Investment in Household Connections

The private sector could also invest in household connections that drive profitability due to greater consumption (80 versus 7 liters per capita per day). Our preliminary analysis in Beyin (Western Region of Ghana), where we piloted household connections, indicated that they have the potential to make a station financially sustainable. As a next step, we are assessing:

- The incremental investment to establish household connections; and
- Pricing mechanisms that could drive sustainability and improve inclusiveness through cross-subsidizing customers that collect water.

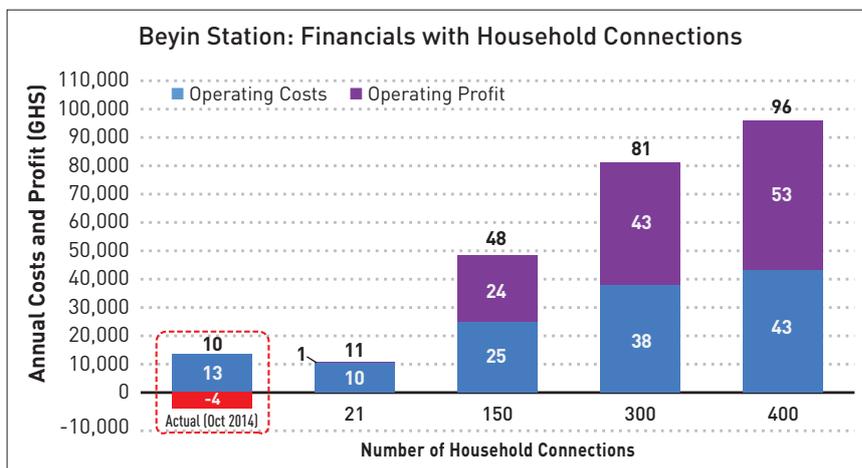
**Figure E:** Investment in a substation can offer full capital recovery faster than a main station as a larger population is reached through a lower capex per capita.



<sup>14</sup> Estimated capital expenditure based on our recent experience in Tongor with MSSF. Capital expenditure per capita is higher than in Figure B because Figure B includes capital expenditure for Stations and Substations versus main Stations alone.

Figure F shows our projections for the impact of household connections on profitability based on Beyin Station revenues and costs<sup>15</sup>. We are still evaluating the potential of household connections in communities such as Dzemeni and Tongor in the Lower Volta Cluster.

**Figure F:** With 21 household connections, the Beyin Station becomes profitable, with a significant potential increase in profits on expansion of up to 400 households.



## 6 | Risks Associated with Financial Performance

Assumptions around the cluster performance include:

### i. Pricing:

Our price is determined to maintain inclusiveness and also ensure financial sustainability; however, external factors, such as competition, policies, and regulation, in addition to demand fluctuations, may require that we adjust pricing as necessary.

### ii. Policy Environment:

Any changes in the regulatory environment and policy revisions around pricing, ownership, and permission to operate could affect our model in these areas.

### iii. Availability of Source Water:

Our consumption and volume assumptions rely on continuous availability of water at the source. Although we conduct a thorough assessment of source water before establishing a station, at times externalities and environmental factors could lead to changes.



<sup>15</sup> Beyin Station runs on limited mechanization technology, while in the Lower Volta Cluster we only have stations operating on MSSF technology. The operating costs of both these technologies are similar, making them comparable.



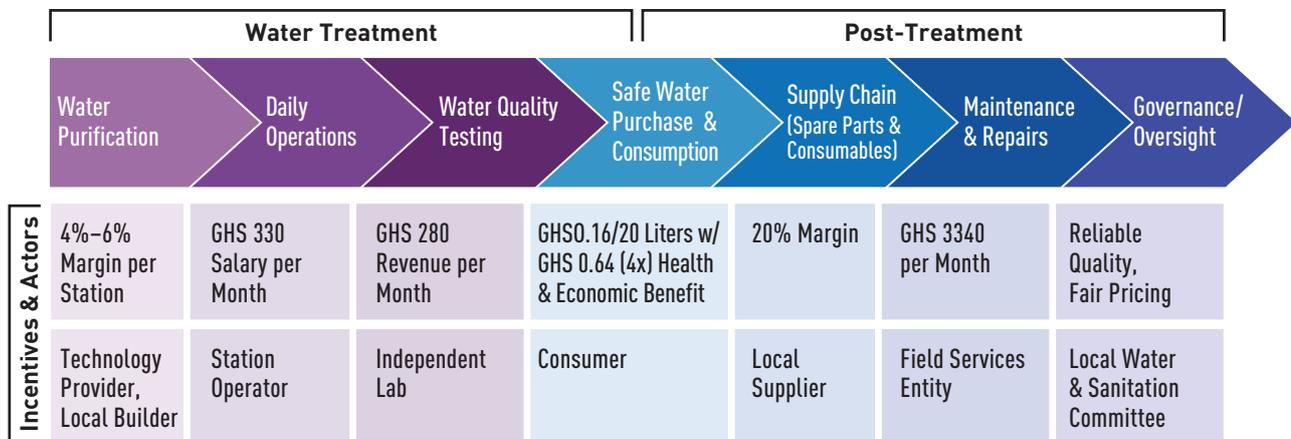
# ANNEX

## 1 | Value Chain for Public and Private Sectors in Community Water Provision

The value created through the multiple goods and services, represented in Figure G below, contributes to a financial proposition for private-sector engagement in community water provision. Value is created along the entire chain of stakeholders. The key actors who deliver each value component in the chain have a vested financial interest, which ensures that the chain is strong and enduring over the long term. The graphic below describes the actors and their roles as well as incentives in the chain, including:

- Technology providers and local builders to construct a water station
- Local station operators to manage the daily tasks
- Service providers, including technicians who offer operation and maintenance support, and laboratories that analyze water quality
- Suppliers that sell spare parts and consumables
- Consumers who experience improved health and quality of life with safe, affordable water
- Local water and sanitation committees that can offer reliable quality and affordable pricing to community members
- Government that benefits from a cost-effective use of national funds

**Figure G:** Value is created along the entire chain of stakeholders of community water provision.

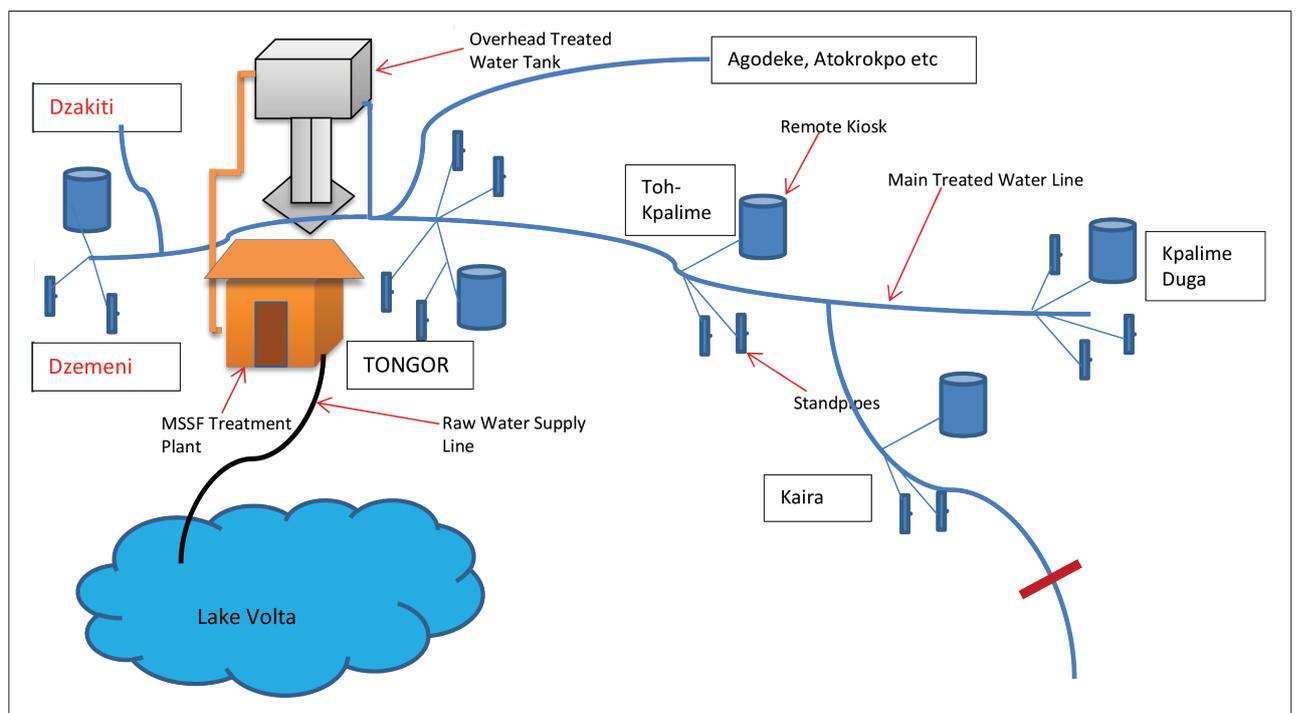


Note: Some value chain components occur at the same time.

Exchange Rate: 3 GHS = 1 USD

## 2 | Map of Lower Volta Cluster

### Dzemeni-Tongor Station: Treatment and Distribution Process Map







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March 2015