USAID/DIV Midterm Report

Building Sustainable Sanitation in Urban Slums

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EXECUTIVE SUMMARY

Sanergy continues to be in the forefront in the slums of Nairobi when it comes to improving access to clean and hygienic toilets. This is achieved by developing successful local entrepreneurs to profitably own and operate hygienic sanitation facilities for their community. The Fresh Life Operators (FLOs), as they are called, create jobs for themselves, their families and employ others from the informal settlement to run the toilets for them.

As of May 31, 2012, Sanergy has deployed 33 toilets to 24 franchisees. Our network of toilets is providing hygienic sanitation to more than 1,800 residents daily and has been used more than 100,000 times. Our waste management operations have safely removed and processed 39 metric tons of fecal sludge from polluting the environment and destroying public health in the community.

SUMMARY RESULTS

Results Indicators	
Number of sanitation centers and latrines delivered	33
Number of local entrepreneurs who have a franchise	24 (15 Female, 9 Male)
Costs to build facilities	USD 250
Operating and Maintenance Costs	USD 0.40/day
Profit generated by Franchisees from operating the Sanergy toilets	USD $2.83/day
Number of residents in the communities who use the Sanergy toilets	1,815 people (944 female, 871 male)
Metric tons of waste collected	39 metric tons
Amount of waste processed into byproducts (organic fertilizer)	39 metric tons
New jobs created to operate and maintain facilities	86

1. INTRODUCTION AND BACKGROUND

Sanergy is on the forefront of improving access to clean and hygienic sanitation within the informal settlements in Nairobi. We are working particularly within the Mukuru and Viwandani slums, an area of approximately 3 square kilometers that is home to about 500,000 people.

During the initial baseline survey conducted in 5 areas where Sanergy intended to install toilets, it was evident that the potential users were either un-employed 31.7%, in formal employment 27.9 %, 102, self -employed 20.5% or in business 9.6%. In terms of income levels, majority 73.2% of respondents earned between 100 and 499 shillings a day while 3.3% respondents indicated that they earned less than 100 shillings in a day. In relation to knowledge about the association between sanitation and ill health, it emerged that 75.7% of the respondents correctly associated diarrhea with poor sanitation, 64.1% associating cholera with poor sanitation and 21.1% mentioned dysentery. The respondents also have good knowledge of what spreads diarrhea in the community; 54.2% mentioned open defecation, and 53.0% not washing hands after defecation. Prevention mechanism mentioned included hand washing 47.8%, drinking treated water 41.2% and 43% mentioned using toilets/latrines.

Based on the baseline information and available data about sanitation in informal settlements, Sanergy has set out measures to improve the sanitation behavior and practice in the community. Sanergy strives for quality of service and prides itself in being the best service provider of its kind in the sanitation sector. Through its UDDT technology, it promotes sanitation in the community through an innovative model. The demand for toilets in the target area is high and Sanergy strives to tap into this potential, during which it creates jobs for local community members while also providing a critical service. The 'flying toilets' is a real testimony of the situation. According to Gulis, et.al (2004), most of the Nairobi slums have few pit latrines which serve a large population, while some slums have none; the result of this is that there are a high number of individuals to toilet ratio thus the eruption of ''flying toilets.'' Furthermore, the solid waste thrown in the plastic bags gives the community additional bad smell as much as it exposes them to the threat of disease. The Fresh Life toilets, made by

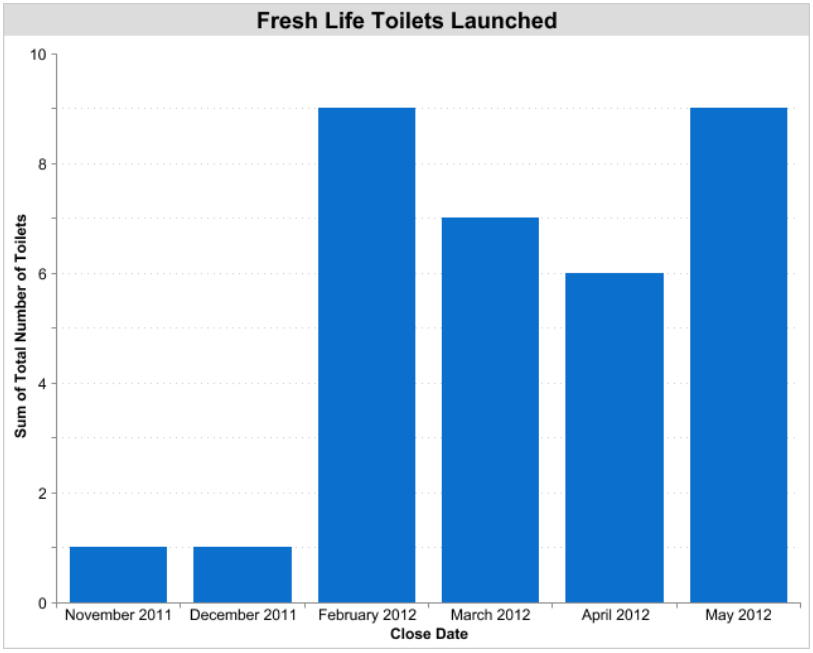
Sanergy, provide the right intervention at the right time and in the right place. Indeed, as the Fresh Life toilet brand gets more rooted in the community, the poor hygiene related indicators associated with inaccessibility to toilets may be a thing of the past.

2. MIDTERM PROGRESS INDICATORS

This section assesses the progress that has been made from November 17, 2011 to May 31, 2012. Areas assessed include the number of sanitation centers and latrines delivered, entrepreneurs with the franchises, operational and maintenance costs for franchises, revenue generated by Franchisees from operating the Fresh Life toilets, number of residents using the Sanergy toilets by gender, metric tons of waste collected, amount of waste processed into byproducts, and new jobs created to operate and maintain facilities by gender.

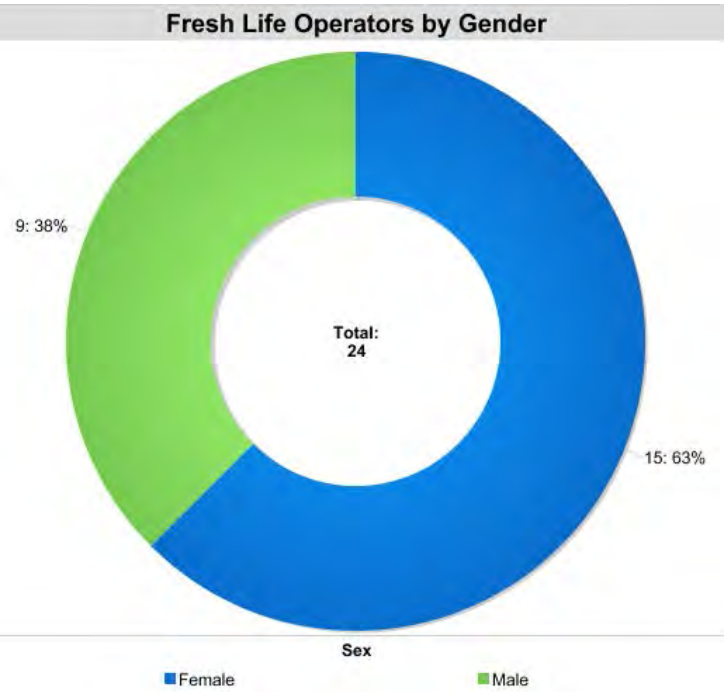
2.1. Number of sanitation centers and latrines delivered

In our workshop, located within the boundaries of the project area in Mukuru kwa Ruben, Sanergy manufactures high-quality low-cost small-scale sanitation facilities made of prefabricated cement using local materials. We have hired and trained a total of 15 staff in the manufacturing and installation of toilets. We are now successfully manufacturing our toilets at a rate of 4 per week in our pilot fabrication facility and have produced a total of 55 toilets.



Sanergy has continued to register steady and improved growth with regard to toilet construction. As of May 31, 2012, a total of 33 toilets have been successfully franchised and deployed. All the toilets are designed and installed with a view of meeting high technical and quality standards. For this reason, each of the toilets has, and continues to meet the quality standards that have been set, and which we have constantly promised to deliver.

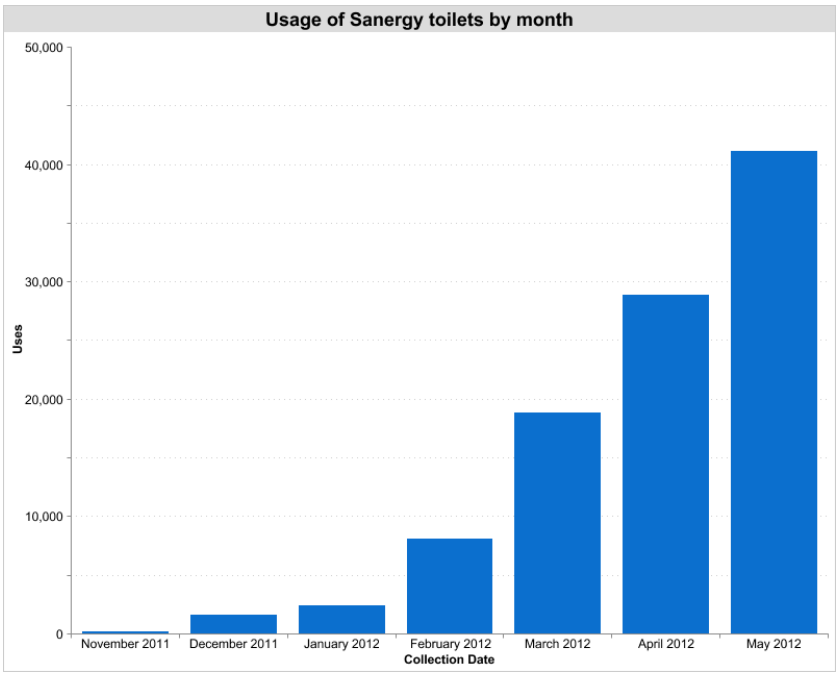
2.2. Number of local entrepreneurs who have a franchise



The number of entrepreneurs with the Fresh life brand has steadily increased as well. As of May 31, 2012, 24 entrepreneurs have franchised the 33 toilets deployed. Of the 24 entrepreneurs, 15 are women (63%) and 9 (37%) are men. All of the franchisees have never been in the sanitation business before. In informal conversations with franchisees, they indicate that what attracted them to this opportunity was the affordable investment combined with the package of support services provided by Sanergy, particularly the daily waste collection, that made the experience as simple as purchasing a business-in-a-box. For example, Agnes Kwamboka, one of our franchisees, used to sell illegal liquor in the community. She is now operating a Sanergy toilet and providing a valuable and critically needed service to her neighbors and community. Other entrepreneurs, like Peter have added on the toilets as an additional income stream to their existing small businesses like water or food sales.

An additional 51 entrepreneurs have applied to become franchisees and have ordered 72 additional toilets. We are currently working with these applicants to help them secure the land, capital, and training necessary to become successful franchisees.

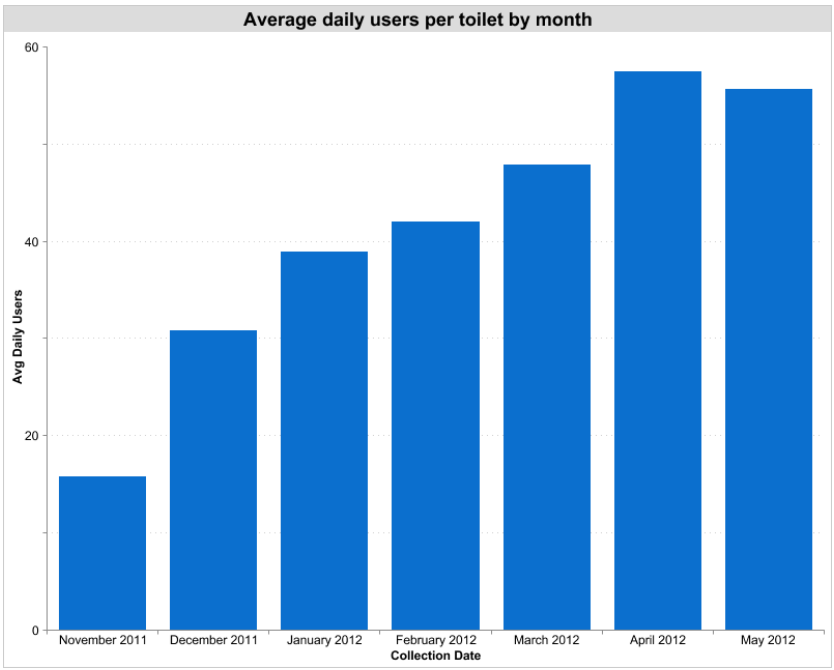
2.3. Number of residents using Sanergy toilets



Sanergy toilets have been used more than 100,000 times in the period between November 17, 2011 and May 31, 2012. On average, each toilet has 55 users per day, creating a significant source of income for the franchisees. We use a combination of waste collection data and surveys to get an understanding of daily usage. Using a random sampling method, surveyors hired by Sanergy are assigned to different franchises to take a user census and conduct exist surveys of users. We combine this with the waste collected for that day to arrive at a ratio of 0.385Kg fecal sludge per use. We use this ration to estimate daily usage at each franchise.

Each day, more than 1,800 residents now have access to hygienic sanitation because of Sanergy toilets. We conducted a baseline survey of nearly 500 users to understand the existing sanitation situation. Our usage surveys indicate that approximately 52% of our users are female and 48% are male. In addition, 96% of them live in households with 6 or fewer members, 52.8% of users have completed secondary schooling, and 73% earn 100-499KES per day. A detailed baseline analysis is attached to this report. The key points from this baseline are that the two primary factors driving usage to Sanergy toilets are accessibility and affordability. In fact, 88% of users were from within 100m of the toilet and only 3.3% of our users earn less than 100KES a day. A significant number of our users were also previously using “flying toilets”, the practice of defecating in a plastic bag and disposing it in public areas. Our results provide strong evidence

that if hygienic sanitation is accessible and affordable, behavior change is feasible and possible in just a few weeks.



We have also developed an extremely effective sanitation marketing program. Using a combination of public events, flyers, information sessions, our marketing programs increase the public awareness of the need for hygienic sanitation as well as Sanergy toilets as a valuable and cost-effective option. We found public events to celebrate opening of new toilets to be particularly effective. Even as we have grown the size of the network, the amount of business at each toilet as increased. The average number of daily users per toilet has increased from 15 in November 2011 to 55 in May 2012. Thus, future growth in number of residents using Sanergy toilets will come from both an increase in the number of toilets, but also an increase in users at each toilet. This will add to the profitability for each franchisee while also significantly improving public health in the community.

2.4. Operating and maintenance costs for franchises

Franchisees do incur costs in their daily operations both to ensure client satisfaction and to maintain quality standards. The operating and maintenance costs for all franchisees are basically similar as they most expenses are soap, water, and toilet paper. Unique scenarios affecting a small proportion of franchisees include paying rent for renting a piece of land where the toilet is installed or where one employs someone else to run the toilet because of the

success of the . Table below indicates the costs incurred by franchisees for both operations and maintenance.

Item	Quantity	Costs (KES)	Duration (Days)	Avg daily cost (KES)	Avg daily cost (USD)
Water	20 Litres	5	1	5	$0.06
Tissue	1 Roll	73	7	10.4	$0.12
Sawdust	1 Sack	100	30	3.3	$0.04
Soap	1 piece	15	7	2.1	$0.02
Detergent	5 Litres	780	60	13	$0.15
Total				33.8	$0.39

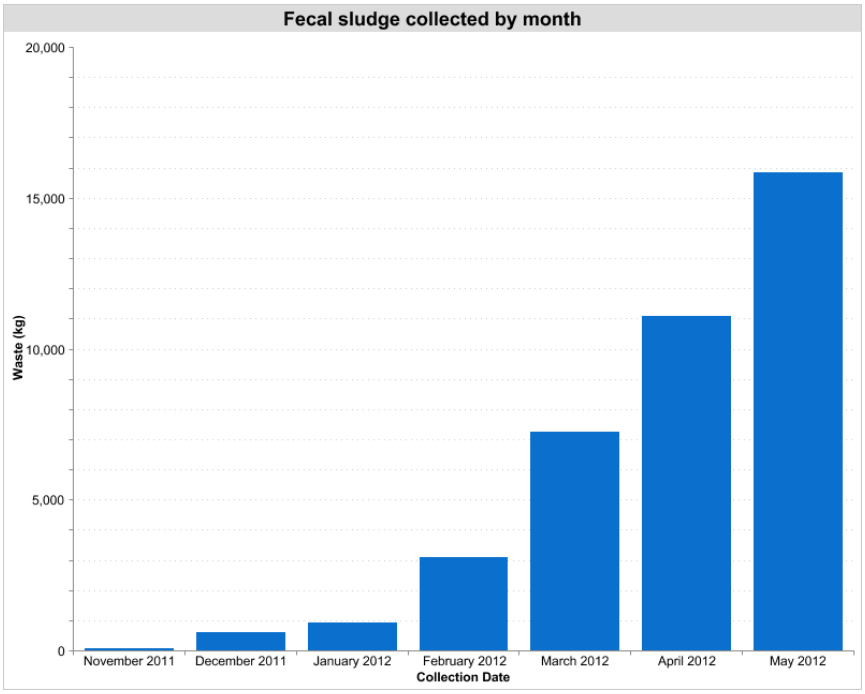
2.5. Revenue generated from operating the Sanergy toilets

From the table above, an FLO charging Kshs 5 per user with the current average of 55 users a day is capable to generate revenues KES 275 (USD $3.24) per day and of profit of KES 241 (USD $2.83) per day. This creates an additional income of up to USD $1,020 per toilet per year for each franchisee. If the franchisee employs an assistant to help, it adds an additional KES 100 (USD $1.19) per day in cost. However, the franchisees that have hired assistants usually do so because their business is doing very well and they now own multiple toilets. The profitability of the FLTs also increases with an increase in the number of users per day. Sanergy continuously provides support to franchisees to ensure that they not only actively participate in making the community cleaner but also ensures that they are running successful businesses. The support that Sanergy provides to the FLOs includes ongoing field manager support, where Field Managers visit the franchisees on site and offer continuing business support. This includes ongoing training on record keeping, enforcing quality standards to ensure they have a competitive edge over their competitors and ongoing marketing on needs basis.

The number of FLOs purchasing a second toilet is also steadily growing; 8 of our franchisees have purchased more than one toilet. This was necessitated by increased number of users leading to queues. The purchase of additional toilets by existing FLOs is an indicator of the success of the business and the preference of community members to use Fresh Life Toilets.

2.6. Metric tons of Waste Collected

Sanergy provides daily waste collection to its franchisees. This is done by a group of well-trained Sanergy employees using personal protective equipment and all hired locally. Waste is collected inside the toilet in two double sealed containers for separate collection of urine and feces to ensure safe storage, collection and transport.



As of May 31 2012, Sanergy has 9 employees dedicated to waste management and to ensure that quality and safe waste collection can be provided to all FLO on a daily basis while continuously expanding of the project in terms of toilet numbers as well as area size. Since November 2011, we collected a total of 39 MT of fecal sludge from our FL-toilets which has been safely transported to the treatment plant.

Our entire waste management team which includes waste collectors and treatment plant operators has been trained on health, safety and emergency procedures. They were additionally provided with PPE and trained on the usage and function of the equipment. All

waste is collected daily from all toilets installed and transported to the treatment plant for processing. There has been no incident of spillage or dumping of human waste outside the treatment plant. All plastic bags used for lining of feces containers are disposed by a professional incinerator company

2.7. Amount of waste processed into byproducts

All of the 39 metric tons of waste collected is being composted into organic fertilizer. The compost under production amounted to a total of 37mt by end of May. The amount of compost is lower than the total waste collected due to loss of mass and volume during composting as moisture evaporates and organic matter decomposes. The first batch of co-compost has been tested for pathogens and compost quality standards given by the Kenya Bureau of Standards (KEBS). The results are presented below.

Microbiological analysis

Fecal coliforms are harmless and characteristic for the intestines of warm-blooded animals including humans and therefore also found in feces. That is the reason why these bacteria are commonly used as an indicator for the presence of fecal pathogens and to evaluate microbial quality. The risk of getting ill from pathogens is correlated to the concentrations of fecal coliforms in the sample, hence the higher the amount of pathogens in higher the health risk. Escherichia coli (E. coli) is part of the group of fecal coliforms.

The limits for E.coli according the WHO guidelines is <1000/ 100ml. The result for our first sampling was 20 Fecal Coliforms/100ml and 10 E.Coli/ 100ml thus the WHO criteria as presented in the table below was fulfilled. The second criteria mentioned by the WHO guidelines are Helminth eggs. Unfortunately we were not yet able to identify a laboratory locally which can analyze this parameter. We are however in contact with the NAS Labs, an ISO/IEC certified laboratory which does a range of microbiology tests and might be able to implement the Analytical Method for Viable Helminth Ova in Sludge recommended by WHO for future sample analysis. After the testing, the compost was transferred from the boxes into

windrows for further curing. Windrows will be sampled once more after cooling down to ambient temperature to ensure that health and quality parameters are fulfilled before the selling the final product.

WHO guidelines on microbiological parameters

	Helminth eggs (no. per gm total solids or per Liter)	***E. coli*** (no. per 100 mL)
treated faeces and faecal sludge	<1/g total solids	<1000/g total solids
greywater for use in restricted irrigation	<1/Liter	$< 10^5$ (a) relaxed to $< 10^6$ when exposure is limited or re-growth is likely
greywater for use in unrestricted irrigation of crops eaten raw	<1/Liter	$< 10^3$ relaxed to $< 10^4$ for high-growing leaf crops or drip irrigation

(a)These values are acceptable due to the regrowth potential of E. coli and other faecal coliforms in greywater.

Compost quality parameter

Additionally to pathogens several quality parameter have been measured to ensure compliance with the local compost quality standards recommended by KEBS. All standards are fulfilled beside the minimum concentration for magnesium meaning that it is not allowed to be mentioned on the package or guaranteed to users unless it is present in the given minimum concentrations. All results and KEBS standards are presented in the following table. As mentioned earlier the final analysis and quality control for the compost will be done after curing and before sieving and bagging as curing might still have an effect on the parameter values. Scanned copy of the lab results are attached to this report.

Parameter	**Unit**	**Sanergy Results**	**KEBS standards**	**Fulfilled**
pH		**7.49**	**6.6-8.5**	**√**
Carbon	**%**	**37.21**	**min 12%**	**√**
Nitrogen	**%**	**2.21**	**min 1%**	**√**

C/ N Ratio	**%**	**16.87**	**<20**	**√**
Calcium	**%**	**1.66**	**min 1%**	**√**
Zinc	**ppm**	**105**	**500ppm**	**√**
Copper	**ppm**	**24**	**50ppm**	**√**
Boron	**ppm**	**27**	**20 -30ppm**	**√**
Magnesium	**%**	**0.38**	**min 0.5%**	**should not be advertised/labeled as a feature/advantage of Sanergy fertilizer**
Sodium	**ppm**	**2651**	**No KEBS standards**	
EC	**mS/cm**	**4.98**	**No KEBS standards**	
Dry Matter	**%**	**76.9**	**No KEBS standards**	
Phosphorus	**%**	**0.45**	**No KEBS standards**	
Potassium	**%**	**1.3**	**No KEBS standards**	
Manganese	**ppm**	**1239**	**No KEBS standards**	
Iron	**ppm**	**8089**	**No KEBS standards**	

2.9 New jobs created to operate and maintain facilities by gender

Sanergy's activities have resulted in the creation of 86 jobs in Kenya. As of May 31, 2012, Sanergy has 44 direct full-time employees and 13 direct part-time employees. Our staff is 65% male and 35% female. We hire youth from the community for a variety of roles like sales, marketing, fabrication, installation, waste management, and operations. For a majority of our employees, this is their first formal job and receives critical benefits such as pension and medical coverage that are important safety-nets to ensure their improving standard of living.

Sanergy Employees by Team	Male	Female
Manufacturing	14	1
Waste Management	7	2
Sales	5	2
HR	0	4
Operations	5	4
Marketing	6	7
TOTAL	37	20

In addition, Sanergy's toilet network has created 24 full-time jobs for our franchisees as well as 5 part-time jobs for assistants operating the toilet on behalf of the franchisees. 51% of these indirect jobs are filled by women and 49% by men.

Appendix: Baseline Report

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1.0 Background and Justification

Defining succinct, measurable, achievable, realistic, and tangible (SMART) results in the early conceptual design stage is the first step in managing impact at the community level. The targeted impact then guides the operations and drives the process of implementation monitoring and learning. Setting performance indicators at all levels of a project hierarchy (input-output-outcome-impact) defines the playing field for performance and it is within this context that real time, meaningful learning can occur. The implementation process should therefore be adapted at various points to respond to conditions on the ground and prospects for achieving measurable and meaningful results and impact.

Determining the level at which impact is made or objectives met depends on the benchmarks set during the baseline assessment or at project inception. It is this fact that has necessitated the initiation of a baseline assessment process. The baseline measurement was conducted in Mukuru slums targeting the area that will be covered by 4 Fresh Life Operators (FLO).

Why the baseline measurement

Aim: The process aimed at developing knowledge base for future measurement of the effectiveness of sanitation intervention and the impact on the lives of people using the Fresh Life (FL) toilets.

Objective:

- Determine the knowledge, attitude and practices in relation to sanitation practices prior to FL toilet installation and operation
- Establish the prevalence of sanitation related diarrheal diseases in the area as an indicator of poor sanitation practices
- Profile the characteristics of the current FL toilet users, factors affecting usage and best marketing strategies to increase usage in the existing FL toilets.

Outcome: Baseline document with clear indicators that will act as a benchmark for monitoring and evaluation.

Indicators:

- 90% awareness of Fresh Life toilet within the FLO coverage area
- 25% increase in the knowledge, attitude and sanitation practices

2.0: METHODOLOGY

2.1: Design: Cross sectional survey design was adopted. Baseline data regarding sanitation practices before the installation of the FL toilets were acquired, the prevalence of sanitation related illnesses and at the same time salient information gathered to support the marketing team design targeted marketing strategies.

2.2: Sample Size: A total of 100 individuals were interviewed per FL operation area. This was determined number of clients expected to use one FL toilet per day from the neighborhood or passersby, where the FL toilet is located by the roadside. The approach adopted employed a mix of cluster sample size and population considerations.

2.3: Sampling: Systematic Random Sampling (SRS) was used; the FL toilets are located in residential areas where people live in systematic/arranged plots. The fourth house or business entity with a member present was sampled. Those absent at the time of interview were skipped and return visits made later in the day. Those who were not present by the time the enumerators returned a second time were replaced by the next households.

2.4: Survey Tools: Two specific tools were used; individual/household questionnaires and observation guidelines. Individual questionnaires were administered per household while the observation was made per latrine/toilet used the respondents.

2.5: Enumerator selection and training: Enumerators were picked from a pool of community volunteers that Sanergy has engaged before. Five enumerators were selected, trained for 1 day (*including pretesting*) and sent to the field for 2 days (*per site*) to collect data. Data was collected from the 1st - 7th of February 2012, excluding 2 days of the weekend.

2.6: Data Quality: Each day, data collected was reviewed by supervisor and any missing information or unclear entry clarified. In case of un-coded data, coding was done depending on emerging responses before entry.

2.7: Data Analysis: Data entry and analysis was done using SPSS. First level analysis of data was conducted where frequencies, percentages and cross

tabulations generated. Tables and figures were further developed for better presentation of the data.

3.0: FINDINGS

3.1: Background information

The baseline assessment covered five new FLOs areas; these are clusters of 20 plots having approximately 100 households determined by area to be covered by the toilet(s). The areas included: Peter Mwangi, Agnes Kwamboka, Joseph Njoroge, Daniel Wahome and Lucy Gitau. A total of 498 interviews were conducted, however, there were three spoilt questionnaires and thus deducted from the total count.

Out of the 498 interviewed, 172 (34.5%) were men and 362 (65.5%) were female. This was as a result of the time the interviews were conducted but not by any design; during the day when most men were still at work.

It was established that the average number of people per household was 1.42 (*SD 0.57*). Majority (63.5%) of the households have 1-3 people living in the same housing unit.

Table1: Number of people per household

FLO	1-3 People	4-6 People	7-10 People	Total
Peter	61	35	5	101
Agnes	66	28	5	99
Joseph	55	43	2	100
Caroline	65	29	4	98
Lucy	69	27	4	100
TOTAL	316 (63.5%)	162 (32.5%)	20 (4.0%)	498 (100%)

Considering the age group of those interviewed, the majority were young adults aged 18-35 years 375 (75.3%) and adults aged 35 years and above 106 (21.3%). Children under 13 years and 13-18 years were only 2 (0.4%) and 20 (4.0%) respectively. This can be explained by the fact that the surveys were conducted during school days and it was difficult to find the school going age groups at that particular time.

The education levels are however distributed as shown in table 2 below. From the table it can be observed that most residents have some basic education and as such marketing or tools that require someone with ability to read can be used in the areas.

Table 2: Education Levels of Respondents

FLO	In Primary	In secondary	Primary Complete	Secondary Complete	Tertiary	Total
Peter	0	1	24	59	17	101
Agnes	1	2	50	42	4	99
Joseph	3	2	13	70	12	100
Caroline	2	1	47	39	9	98
Lucy	0	2	39	53	6	100
TOTAL	6 (1.2%)	8 (1.6%)	173 (34.7%)	263 (52.8%)	48 (9.6%)	498 (100%)

3.2: Main source of income:

Most of the respondents indicated that they are un-employed 158 (31.7%), moreover 139 (27.9 %) were in formal employment, 102 (20.5%) were self -employed and only 48 (9.6%) were in business. The others were dependents, children in school or college.

3.3: Daily Income:

This indicator was added after the baseline survey had been conducted in Joseph's area. However, in other FLO areas among those who had a source of income, majority, 134 (73.2%) of respondents earned between 100 and 499 shillings a day, while 43 (23.5%) earned 500 shillings and above per day. Six (3.3%) respondents indicated that they earned less than 100 shillings in a day.

3.4: Illnesses associated with lack of latrines/toilets

This was a multiple response question; respondents were required to mention as many illnesses as they could remember. It emerged that, 377 (75.7%) of the respondents correctly associated diarrhea with poor

sanitation, followed by 319 (64.1%) associating cholera with lack of sanitation and whereas 105 (21.1%) mentioned dysentery. Others also mentioned included amoeba, bilharzia, TB, worms and typhoid as well as malaria as illnesses associated with lack of latrines/toilets. Figure 1 below summarizes the responses.

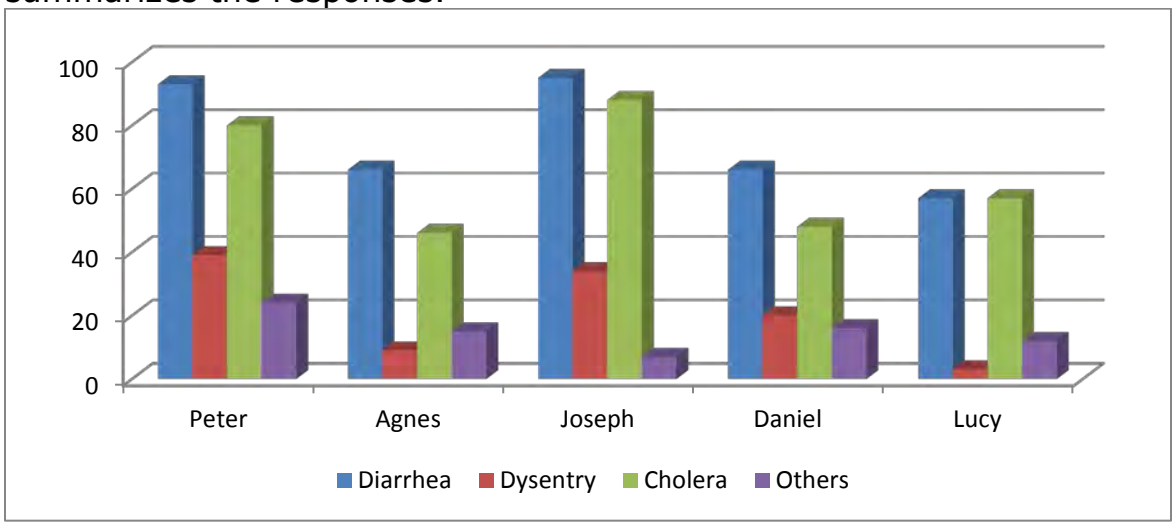

Figure 1: Illnesses associated with lack of latrines

3.5: Incidences of diarrhea in the households

On average 89 (17.9%) of the respondents reported having experienced an episode of diarrhea in their households in the past 2 weeks. There was no significant difference between the areas, though the lowest numbers were reported in Lucy's area with only nine respondents reporting episode of diarrhea in their households. Out of the 17.9% who reported episodes of diarrhea in the households, 62 reported only one member having been affected, whereas 22 reported 2 members, 5 reported 3 household members and only 1 reported 4 household members having been affected.

3.6: Causes of diarrhea

In an open ended multiple response question about causes of diarrhea, the respondents mentioned open defecation (54.2%) and not washing hands after defecation (53.0%) as some of the common causes of diarrhea in the community. Table 3 below shows the summary.

Table 3: Perceived causes of diarrhea

FLO	Open Defecation	Not Washing hands	Drinking Untreated Water	Others	Don't Know Causes

Peter	59	56	38	2	1
Agnes	49	46	33	1	2
Joseph	58	62	59	0	0
Daniel	51	44	36	1	4
Lucy	53	56	32	10	1
TOTAL	270 (**54.2%**)	264 (**53.0%**)	198 (**39.8%**)	14 (**2.8%**)	8 (1.6%)

3.7: Prevention of Diarrhea

Similar to the question on causes of diarrhea, washing hands after visiting the toilet was predominantly mentioned by 238 (47.8%) respondents as one of the methods for preventing diarrhea. In addition, 205 (41.2%) of the respondents mentioned drinking treated water exclusively as the surest way of preventing diarrhea whereas 214 (43.0%) mentioned using toilets/latrines. Other methods mentioned included maintaining proper hygiene, avoiding dirty food, medication and improving the drainage system as other methods of preventing diarrhea. The difference between the FLOs is shown in figure 2 below.

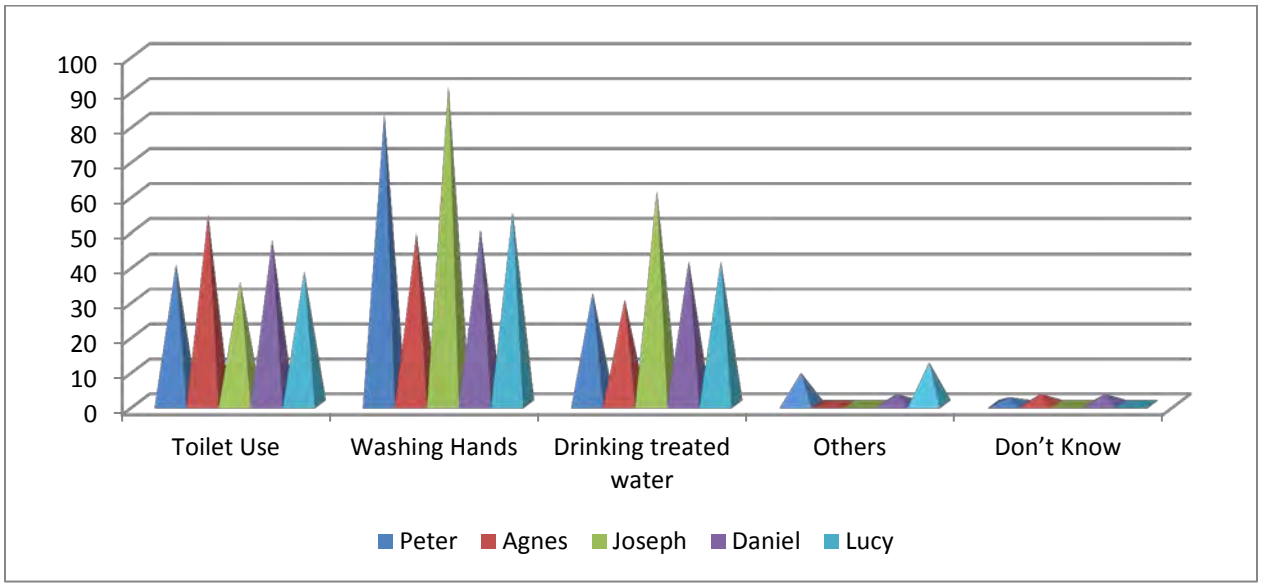

Figure 2: Methods of preventing diarrhea

3.8: Frequently Used Sanitation Options

The trend in latrine/toilet usage in the five (5) FLO areas is distinct; there are few toilets within the residential plots thus the high number of usage of commercial toilets/latrines and similar number of users of flying toilets or open defecation. Most people are using a combination of options (pits, flying

toilets) to meet their sanitation needs based on time of day and the conditions of the toilets they usually access.

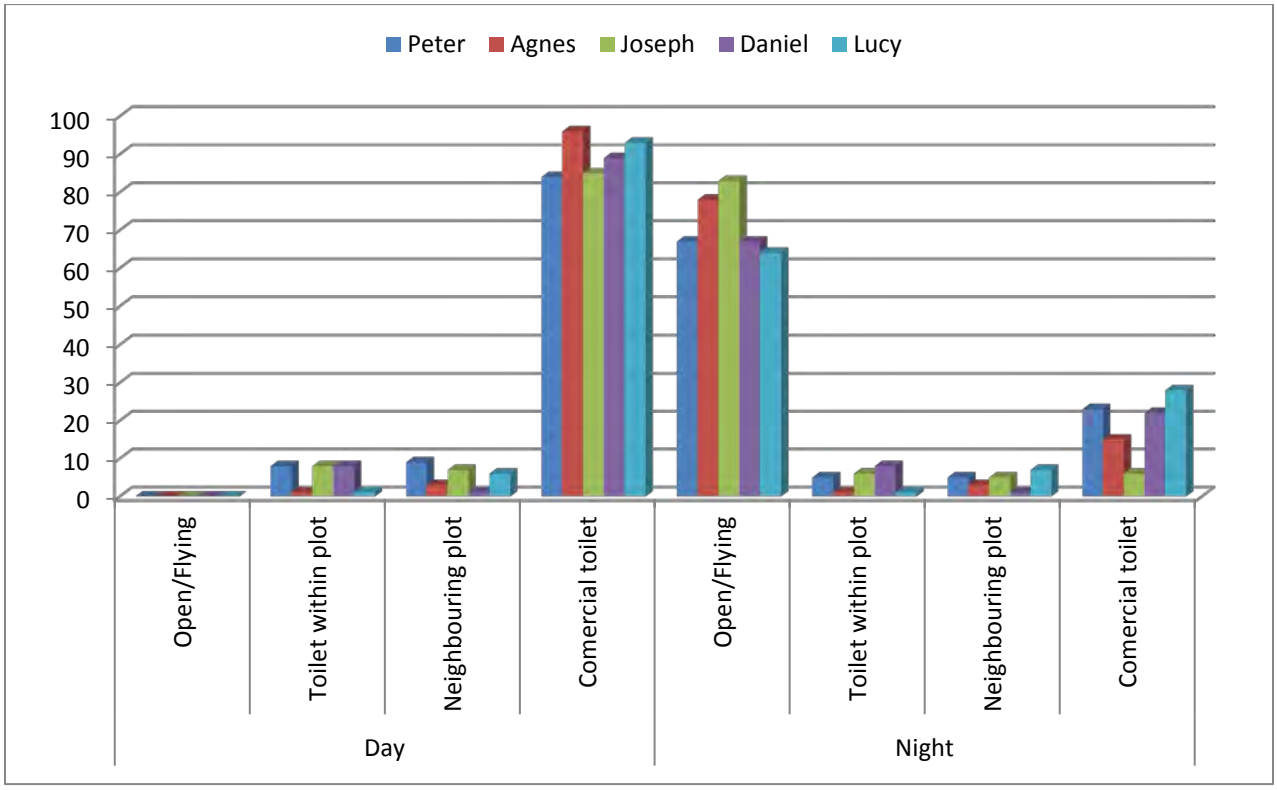

Figure 3: Toilet/Latrine Usage-Day and Night

3.9: Location of the current toilet/latrines used by the respondents

Most of the respondents (94.2%) in all the FLO areas indicated that they used toilets located out of their residential place [*usually a set of single rooms with shared bathroom and common open areas]*. There were only few cases in Daniel's and Peter's area where there were toilets within the residential area. This presents a good potential for success of the fresh life toilets in the areas.

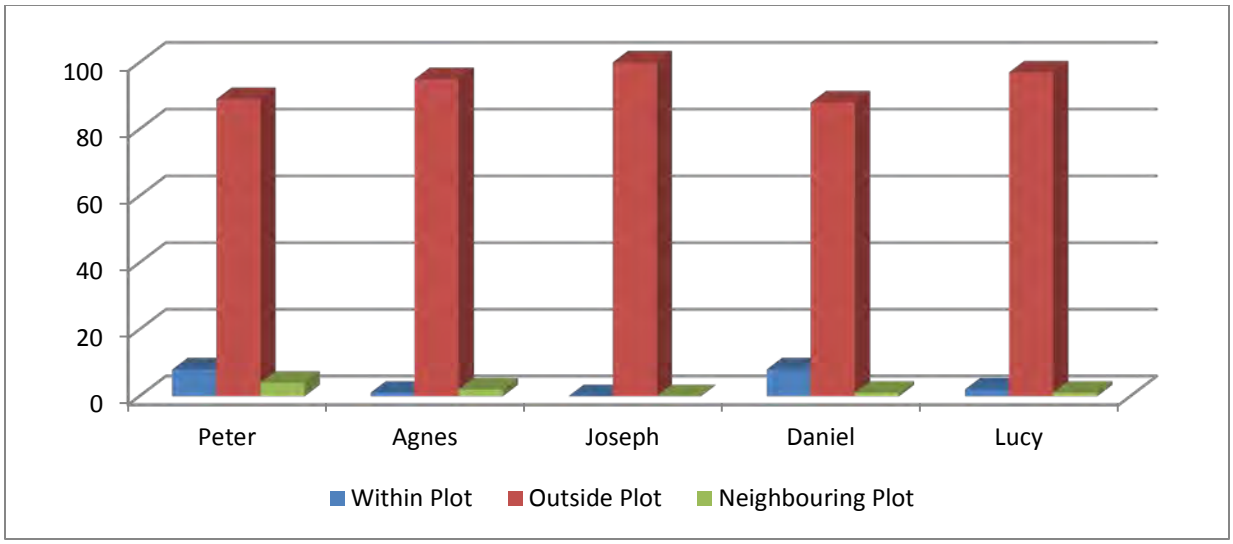

Figure 4: Location of toilets currently used

3.10: Approximate distance to the toilet regularly used

Majority (40.1%) of the toilets located outside the residential plot are approximately 50-100 meters away while only a few (11.4%) were using toilets located over 100 meters away from the residential plot.

Table 4: Approximate distance to toilet regularly used

FLO	10-20m	20-50m	50-100m	>100m
Peter	18	11	51	21
Agnes	26	44	28	1
Joseph	5	3	61	31
Daniel	20	40	32	1
Lucy	35	37	25	2
TOTAL	**104 (21.1%)**	**135 (27.4%)**	**197 (40.1%)**	**56 (11.4%)**

3.11: Fear/worry at night

Fear of thieves, thus leading to mugging/theft or injury was the biggest worry of most respondents (64.7%). Others (6.5%) feared police, rape and the fear of the unknown in the darkness were also mentioned.

3.12: Cleaning and maintenance of toilets/latrines

Most of the respondents in the areas use commercial toilets and 80% reported that the toilet they were using was maintained by an employed staff and 12% by caretaker. The remaining 8% had toilets in their residential area and indicated that they were being maintained by either landlords or the residents themselves.

3.13: Hygiene after visiting toilet/latrine

None of the respondents using either a commercial or latrine/toilets within the residential place reported presence of water and soap for hand washing in the latrines/toilets. Moreover, only 25% of the respondents reported availability of tissue paper for use after visiting the commercial toilet/latrine. In the residential plots/latrines, the residents have to take care of their own tissue and hand washing after visiting the toilet/latrine.

Crop Nutrition
Laboratory Services
Healthy, Profitable Farming

Client : Sanergy

Analysis : Complete Manure Analysis

Date : 27 Apr 2012

PARAMETER	UNIT	CNLS RESULTS	KEBS STANDARDS
pH		7.49	6.6 – 8.5
EC Salts	mS/cm	4.98	-
Dry Matter	%	76.94	-
Carbon	%	37.21	12% (Min)
Nitrogen	%	2.21	1% (Min)
C/N Ratio	%	16.87	<20:1
Phosphorous	%	0.45	-
Potassium	%	1.3	-
Calcium	%	1.66	1% (Min)
Magnesium	%	0.38	0.5% (Min)
Manganese	ppm	1239	-
Iron	ppm	8089	-
Zinc	ppm	105	0.5%
Copper	ppm	24	0.05%
Boron	ppm	27	20 – 30%
Sodium	ppm	2651	-
Faecal E. Coli	Cfu/100ml	10	-
Faecal Coliforms	Cfu/100ml	20	-

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USAID/DIV Final Impact Analysis: November 2011 to July 2012

SANERGY

Sanergy - Building Sustainable Sanitation in Urban Slums
DIV 189 PD 1.2 2011

October, 2012

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1.0 Executive Summary

Comment [O(1]: The report needs to follow the branding/marking policy (see Modification #2)

Provision of hygienic sanitation is one of the most effective public health interventions, yet 40% of the world continues to remain without access to basic sanitation. At Sanergy, we have developed a vertically integrated system for sanitation service delivery in urban slums: a dense network of small-scale toilets close to homes, a low- cost containerized waste transportation infrastructure, and a centralized processing facility that efficiently converts waste into high-margin products such as fertilizer, and electricity. By combining new appropriate technology with a scalable deployment strategy, we have created a financially and environmentally sustainable sanitation cycle in urban slums.

The strategic objective for this Stage 1 implementation was to achieve an increased use of sustainable and hygienic sanitation in Mukuru community. The main objective was to increase the percentage of people using hygienic sanitation facilities described as the number of people using hygienic sanitation facilities divided by the total number of people measured through monthly household interviews throughout pilot area.

By the end of the pilot phase on average, 2914 people were using Fresh Life Toilets (FLT) daily; this translates to approximately 42.7% of the target population within a 25 meter radius of the toilets. The level of awareness of hygienic sanitation practices improved significantly from 53.8% during the baseline measurement to 86.3%. This surpassed the targeted 75% awareness level. Similarly, the number of residents using hygienic facilities within 50 Meters radius increased from 28.1% during the baseline to 93.1% by the end of the pilot phase. The Key points are summarized in table 1 below.

Table 1: Summary of Results Delivered

Results Indicators	
Number of sanitation centers and latrines delivered	62
Number of local entrepreneurs who have a franchise	44 (Males: 18 Females : 24 Males)
Costs to build facilities	250 $
Operating and Maintenance Costs	$0.4-$1.6/day
Average Revenue generated by Franchisees from operating the Sanergy toilets	$ 84.9/month (Range $ 57 - $ 150/ month)
Number of residents in the communities who used the Sanergy toilets	Female: 1598 Male: 1371
Metric tons of waste collected	84.979 MT
Amount of waste processed into byproducts (compost)	84.979 MT
New jobs created to operate and maintain facilities	**Sanergy** -43 Males - 19 Females **FLOs** -9 Males -13 Females

Comment [O(2]: This figure hasn't changed since the last quarterly report submitted in March – why?

In conclusion, the strategic objectives for this stage were met and in most cases exceeded. Meeting the 60 toilets installation target has opened up the space for more interest in the community. More community members have since purchased the FLT and by the time of writing this report we have 110 functional FLTs.

2.0 Introduction and Background Information

2.5 billion across the world and 8 million people in the slums of Kenya lack access to basic sanitation. The lack of sanitation leads to contaminated waterways and food supply, as well as direct infection through contact with human waste. The resulting diarrheal disease is the second leading contributor to the global disease burden and kills nearly 1.6 million children each year. The high population density combined with the lack of infrastructure and resources makes the problem particularly acute in slums, where populations will double to 2 billion by 2030.

Like in most countries across Sub-Saharan Africa, Kenya is at the epicenter of this crisis. 10 million people live in the slums of Kenya, 80% of whom lack access to basic sanitation. Despite having to pay up to $0.10 per use, the poor rely on unhygienic pit latrines and "flying toilets." At the same time, the country endures a 40% unemployment rate, faces a 3000 MW electricity generation shortage, and has to subsidize 1 million tons of fertilizer imported at extremely high prices to meet local demand.

Tackling the sanitation crisis requires more than just building toilets. We took an innovative systems-based approach to pioneer a model for low-cost off-grid infrastructure that provides safe and affordable sanitation to slum dwellers across Kenya. We combined novel technologies with a realistic deployment strategy in our sustainable sanitation cycle that featured three major parts: a dense network of small-scale sanitation centers franchised to local entrepreneurs across the slums, a low-cost waste collection infrastructure using handcarts instead of sewers and trucks and a centralized processing facility that converts the waste into electricity and commercial-grade organic fertilizer

Prior to launching the pilot, we conducted a baseline survey to determine the current rates for each target indicator. Subsequently, we continually monitored each metric throughout the pilot, particularly the progress on our strategic objective, as measured by the percentage of people using hygienic sanitation facilities. If and when this usage did not increase at our target rate, we re-examined the indicators for each intermediate result in order to identify implementation adjustments to make. We initiated marketing and behavior change communication activities in the implementation areas to address any shortfalls.

During the implementation period, several strategies and models were tested, deployed, monitored and re designed. This involved operational, sales and marketing as well as technical designs. In specific, the tools used by the operation team and the design of the squat plate for example changed more than once. The overarching goal of these changes was increasing FLT penetration and usage in the community. Secondly, the changes were necessitated by the feedback during the surveys as well as ad hoc feedback by users during visits to the community.

This report therefore examines the results of each indicator and the change relative to the initial baseline data. The details of the implementation processes are not covered

Comment [O(3]: Why not?

3.0 Summary of Processes, Results and Data

3.1 Baseline Process

The baseline measurement was conducted in Mukuru slums targeting areas where the Fresh Life Toilets (FLT) were to be installed. The process aimed at developing knowledge base for future measurement of the effectiveness of sanitation intervention and the impact on the lives of people using the FLT. The main objectives were to; determine the knowledge, attitude and practices in relation to sanitation practices prior to FLT installation and operation, establish the prevalence of sanitation related diarrheal diseases in the area as an indicator of poor sanitation practices and profile the characteristics of the potential FLT users, factors affecting usage and best marketing strategies to increase usage in the FLT.

The outcome was a baseline document with clear indicators that acted as a benchmark for monitoring and evaluation. Indicators developed were; 90% usage of Fresh Life toilet within the FLT coverage area, 25% increase in the knowledge, attitude and sanitation practices, 25% decrease in cases of ill health related to poor sanitation practices and availability of 1 Fresh Life Toilet per 50M radius in the community to increase access to sanitation services.

Comment [O(4]: What are the endline data points for these indicators and how were they measured?

Cross sectional design was adopted where baseline data regarding sanitation practices before the installation of the FL toilets were acquired, the prevalence of sanitation related illnesses and at the same time salient information gathered to support the marketing team design targeted marketing strategies. A total of 100 individuals were interviewed per FL operation area identified through a systematic random sampling (SRS). Two specific tools were used; individual/household questionnaires and observation guidelines. The tools were administered by five enumerators selected from a pool of community volunteers that Sanergy has engaged before. Data was collected from the 1st - 7th of February 2012, excluding two days of the weekend.

Comment [AN(5]: Please describe these methods in more detail. How did the enumerators decide who to sample? Was this conducted for all FL toilets? If not, for how many toilets, and how were these selected?

The results of the baseline indicated that most of the potential users were either un-employed 31.7%, in formal employment 27.9 %, self -employed 20.5% or in business 9.6%. In terms of income levels, majority 73.2% of respondents earned between 100 and 499 shillings a day while 3.3% respondents indicated that they earned less than 100 shillings in a day. In relation to knowledge about the association between sanitation and ill health, it emerged that 75.7% of the respondents correctly associated diarrhea with poor sanitation, 64.1% associating cholera with poor sanitation and 21.1% mentioned dysentery. The respondents also have good knowledge of what spreads diarrhea in the community; 54.2% mentioned open defecation, and 53.0% not washing hands after defecation. Prevention mechanism mentioned included hand washing 47.8%, drinking treated water 41.2% and 43% mentioned using toilets/latrines.

Comment [AN(6]: Was this based on open-ended or fixed response questions?

3.2 Ongoing data collection processes

1.2.1 Daily FLO reports:

The Fresh Life Operators (FLOs) collect on a daily basis user's statistics. This is disaggregated by gender: Male - Female as well as by age categories: Adults – Children. In addition to the usage data, the FLO's also collect revenue and expenditure data which helps in the calculation of profitability. The initial challenge was how to deal with illiterate FLOs who cannot read or write. However, this was addressed by creating pictorial data collection tools where the FLO tallies/ticks the pictures. This improved the data quality and completeness challenge. The data is subsequently checked and compiled by the Field Officer who visits the FLO on a weekly basis. Despite the effort and measures put in place to ensure complete and accurate data, some FLOs were not in a position to complete the data collection tool leading to estimation of data using the waste collected from the locations.

Comment [AN(7]: Thank you for noting this challenge. Can you describe the extent to which this happened (how often, for how many toilets, etc)? It would be useful to know what proportion of the figures are based on estimates. Is there reason to suspect that these FLOs would have had higher or lower waste collection levels than average FLOs?

3.2.2 Daily waste collection reports:

The waste management team collects and weighs the amount of feces and urine collected from each toilet. This data is run and managed by the waste management team. In addition, the waste management team collects quality compliance data. This entails the cleanliness of the toilet, the availability of required supplies (water, soap, sawdust) as well as the general maintenance issues of the toilets.

3.2.3 Consumer profiling data:

Exit surveys were conducted on a quarterly basis for a set of toilets. The users are profiled in terms of the demographic information, sanitation and hygiene awareness, views and perceptions in regard to using the FLT. Views and opinions on the usage of the FLT are then incorporated into product improvement as well as factored into the program (training, user education and FLO support). At the same time Non FLT users are also profiled in the same locality to compare the demographics, income levels and reasons for not using the FLT. This helped us understand those who are not using the product and initiate ways (through the marketing team) of changing their behavior.

Comment [AN(8]: How many? How were they selected?

Comment [AN(9]: Please add more detail about the results of this. Were their demographics different? How? What were reasons for not using the FLT?

Also, please specify how many and how were they selected.

The challenge faced with the quarterly approach to consumer profiling was lethargy developed by respondents; questioning the purpose and benefit to them. We are changing the approach such that we will be having 2 surveys per toilet per year; one month after opening the FLT and towards the end of the year.

3.2.4 Competitor profiling

Detailed competitor profiling was conducted in one sub area in Viwandani. The profiling constituted; knowing the type of toilet facilities in existence, the services offered, the users and the challenges faced. At the same time, the GPS locations were identified and a map generated to show the locations. The data was utilized

by the sales team to pitch to the operators as well as potential operators in areas without toilet facilities.

3.3 Data and statistics

Comment [O(10]: The proposal also included (in the table on page 5) indicators related to DALYs, renewable electricity generated, organic fertilizer produced, and carbon offset. Did the project track these measures? If so, please provide the endline figures. If not, please provide a brief summary about why they were not included in regular project data collection.

Distance: There are approximately 375 people residing within 100 Meters of a FLT. Currently, 42.7% of whom use the FLT regularly; majority established to be residing within 20-25 meters of the FLT. There are people residing within the same radius who still use other unhygienic toilets citing user fees as the main barrier to usage. However, as reported through verbal conversations with area residents and elders, there has been a significant and noticeable reduction of flying toilets and open defecation in the target areas since the entry of Sanergy's toilets and services.

Access to Hygienic Sanitation: In terms of improving access to hygienic sanitation facilities, at baseline 51.5% of the respondents used facilities that were 50-100M away from their residence. Currently this has been reversed and 42.7% of residents use FLT within 25M of their residence.

Usage: As at end of July, there was an average of 47 users per FLT per day totaling to 2914 /day in July. Cumulatively, Sanergy provided hygienic sanitation facilities to over 175,000 people. This data excludes people using other facilities in the community. We are not in a position to assess other facilities in the community as at now.

Income: At baseline majority of respondents 73.2% interviewed in the community of respondents including current FLOs earned between Kshs 100- 499 a day ($1.2 - $ 5.9) . Currently the average daily income from FLT is USD $2.83/day. Cumulatively; this translates to $ 84.9/month. This alone is more than double the poverty line amount of $ 35/month. Additionally, some of the FLOs have other sources of income and thus the FLT is an additional income making the consolidated income way above the poverty line.

Waste Collected: Cumulatively, over 84.979 MT was collected from the community, waste which could have ended up contaminating water sources and the environment as well as ill health to the residents.

Waste Processed to by-products: 100% of waste collected and being processed into fertilizer.

3.3 Waste Management

Comment [AN(11]: Please add more detail about progress towards converting waste into energy sources that can be sold commercially .

Comment [O(12]: What progress has been made on selling fertilizer and/or biogas? What was achieved under this project, and what still needs to be done?

3.3.1 Environmental Mitigation Update

Potential adverse impacts identified during the Environmental Assessment include odor emissions, human health and safety hazards during waste collection and contamination of the human and natural environment through spillage of untreated waste during the transport and treatment of human excreta as well as product safety and quality control.

3.3.1.1 Waste Collection and Transport

To minimize risks related to spillage, container breakages or leakage of excreta during collection, transport and treatment all containers used for waste collection have been tested and modified to mitigate this risk as much as possible. Urine containers are spill proof and double sealed with a rubber stopper and a screw cap. Feces containers are additionally lined with plastic bags which are incinerated after usage.

All our waste collectors and treatment plant operators are well trained on health, safety and emergency procedures. Workers involved in collection, transport and treatment of human excreta are provided with Personal Protective Equipment (PPE) including gumboots, dust masks or respirators, full overalls and gloves. Additional training was conducted to educate every team member on personal hygiene as well as usage and benefits of PPE.

Showers, toilets and change facilities are provided onsite. All cloth and shoes used during waste collection, transport and treatment are kept in the facility and cleaned regularly by staff using bleach and antibacterial soap. The equipment is stored in the changing room where it is easy accessible by all waste collectors and treatment plant operators. Staff is personally responsible for maintaining their own PPE and ensures it is properly fitted. Continues monitoring and re-training ensure that health and safety guidelines are followed and PPE is used correctly as required.

3.3.1.2 Treatment and product safety

Product safety and environmental safety is directly linked to fecal pathogen transmission. To ensure that all pathogens in the product are eliminated samples are taken and analyzed for pathogens. The results are compared with the health-based targets developed by WHO and presented in the table below.

Table 2: WHO guideline values (Source: WHO Guideline Executive Summary)

Parameter	Values
E. Coli	<1000/g total solids
Helminth Eggs	<1/ g total solids

The limits for E.coli according the WHO guidelines is <1000/g. The results for 8 boxes and batch 1 (box 1 and 2 combined) are presented in the table below.

Table 3: Pathogen results compared to WHO guidelines

	E.coli cfu/gm	WHO Guidelines
Windrow/ Batch 1	10	<1000/g
Box 3	340	
Box 4	20	
Box 5	270	
Box 6	70	
Box 7	10	
Box 8	<10	
Box 9	30	
Box 10	20	

Pathogens in boxes are measured after a period of 3 month and when composting temperatures decreased to 30-35^0 Celsius. After the testing and only if WHO guidelines are fulfilled, compost is transferred from boxes into windrows for further curing. As shown in the table above, all boxes tested fulfilled the requirements. When transferred to windrows, two boxes are combined forming one windrow or batch. Windrows are sampled after a maturing time of 2-3 month when ambient temperatures are reached and just before compost batch is sold. As shown in the table above the first batch was according to pathogen standards and therefore approved to be bagged.

The second criteria mentioned by the WHO guidelines are Helminth eggs. Samples have been sent to South Africa since there is no laboratory locally available to analyze this parameter. We have not yet received the results from the laboratory therefore they will be submitted during the next report.

Comment [AN(13]: This is the final project report. Do you plan to send a post-award update?

Other compost parameters measured before selling the first compost batch are presented in the following table 4 and are used to determine the quality of the produced compost and the compliance with the local compost quality standards recommended by KEBS. All standards are fulfilled beside the minimum concentration for magnesium meaning that it is not allowed to be mentioned on the package or guaranteed to users unless it is present in the given minimum concentrations.

Table 4: Laboratory results compared to KEBS standards

Parameter	Unit	1st batch	KEBS standards	Fulfilled
pH		7.49	6.6-8.5	√
Carbon	%	37.21	min 12%	√
Nitrogen	%	2.21	min 1%	√
C/ N Ratio	%	16.87	20	√
Calcium	%	1.66	min 1%	√
Zinc	ppm	105	max 500ppm	√
Copper	ppm	24	max 50ppm	√
Boron	ppm	27	max 20 -30ppm	√
Magnesium	%	0.38	min 0.5%	not fulfilled and therefore should not be guaranteed
Sodium	ppm	2651	No KEBS standards	
EC	mS/cm	4.98	No KEBS standards	
Dry Matter	%	76.9	No KEBS standards	
Phosphorus	%	0.45	No KEBS standards	
Potassium	%	1.3	No KEBS standards	
Manganese	ppm	1239	No KEBS standards	
Iron	ppm	8089	No KEBS standards	

3.3.1.3 Odor control

Human excreta are the primary contributor to odor emissions. Due to the lack of enclosed facilities, odor control cannot be performed with room aeration. Therefore, odor emissions are decreased through the minimization of contact between human waste and open air. Excreta remain sealed in the containers, except for the mixing stage. When the waste is unloaded into the compost bins, there is a temporary release of odor into the environment. The piles are covered with an organic biofilter, such as woodchips or bagasse. After composting, the compost has an earthy smell and does not emit odors.

4.0 Programmatic lessons learned

Comment [AN(14]: In this section, please include the results of analysis of non-users. Were their demographics different? How? What were reasons for not using the FLT?

Also, please include preliminary lessons about converting waste into energy sources.

4.1 Implementation as planned

Sanergy successfully launched 62 hygienic sanitation facilities in the Mukuru slum in 6 months. We currently have a network of 110 facilities, owned and operated by 50 sanitation entrepreneurs. 65% of these entrepreneurs are women. All of the facilities are operating at a profit creating sustainable incomes in areas that endure 40% unemployment.

4.2 Limitations experienced during the course of implementation

There were two main limitations: access to land and access to capital:

4.2.1 Land

Informal settlements often lack title to the land where people live and work. We found that a significant number of potential entrepreneurs did not have proper access to land and therefore were unable to purchase the toilet. Sanergy overcame this challenge by focusing its sales initially on long-time established members of the community, who have much more certain land status. As Sanergy becomes well-established in the community, others with more secure land access – the government, community leaders, landlords and civic institutions – have become more inclined to purchase a Fresh Life Toilet.

4.2.2 Capital

Potential entrepreneurs often lacked the liquidity to purchase a Fresh Life Toilet. Sanergy has handled this challenge in two ways:

- Sanergy provided access to loans through a partnership with a local microfinance bank, Faulu and through Kiva, an online lending platform.

- Sanergy developed a payment plan based on installments rather than requiring all of the capital upfront. This eased the immediate financial burden on the entrepreneur, but did not slow down Sanergy's ability to build as the down payment covered the construction costs.

4.3 Lessons Learnt

Go cashless: Sanergy has gone cashless for all transactions between Fresh Life Operators and the company. This enables potential operators to pay immediately and with no risk of theft or fraud in delivering large quantities of cash. This has also helped Sanergy keep stronger track of revenue.
Data Integration: Sanergy has invested heavily in the customization and utilization of Salesforce. This enables us to not only track our sales pipeline, but also keep integrate our M and E work into our daily operations. This ensures that we can understand who makes for the most effective sanitation operator, which we can replicate.
+40 year old women operators: We have found that women over the age of 40 make for the best operators. Over 60% of our operators are women. These women have lived in the community for a long time and command respect because of their concern for public health and their business savvy. This will help us as we scale so that we can more easily identify entrepreneurs.

5.0 Summary of overall conclusions and findings

Overall, Sanergy is now in a much stronger position to scale. We understand the bottlenecks, the tensions and the challenges that hinder growth. We also understand our competitive advantages and opportunities in the future. As a result, we feel well-positioned to expand rapidly in late 2012 and 2013.