

BASELINE SURVEY REPORT

The daytime energy consumption of dwellers in informal settlements (2013)

From

Yaoundé and Douala, Cameroon

(DRAFT REPORT)

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GENUS NETWORK SECRETARIAT'S OFFICE – UN-HABITAT

Presented by:

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EXECUTIVE SUMMARY

FCTV (Fondation Camerounaise de la Terre Vivante) and UN-Habitat have launched a Solar Bulb Project in Douala and Yaoundé. This consists of fitting a plastic bottle filled with water into the corrugated iron roofs of houses without ceilings found in informal settlements. A common characteristic of informal settlements is the lack of indoor lighting during the day. For security purposes, the sizes of windows are most often small in size. This prevents the maximum penetration of natural daylight into indoor spaces, leaving them in darkness. The lack of sufficient ambient lighting during the day hampers the ability of slum dwellers to carry out household chores and other important tasks in these rooms. They actually use candles, kerosene lamps, electricity bulbs, and battery torches during the day, resulting in additional cost implications as well as indoor air pollution and also the risk of having fire incidents.

The solar bottle bulb is an innovative passive lighting system. The lighting produced by one containing one and a half litres of water is equivalent to the light produced by a 50 W incandescent light bulb. A solar bottle bulb lasts for (5) years before its luminescence capacity starts to decline. By using this technology, the members of these households are able to save on energy that was previously used for lighting during the day.

This project is being implemented in several informal settlements in Douala and Yaoundé. The project aims at installing 4,000 solar bottle bulbs within the next three (03) months under the framework of GENUS.

A baseline survey was conducted for five (05) days each in both Douala and Yaoundé in order to understand the energy utilisation patterns during the day, identify the project's beneficiaries, have an idea of the amount of solar bulb demand by the dwellers of these informal settlements, and raise awareness about this gadget. This will make it easier to estimate the impact of the project as economic, social, and environmental indicators.

1. INTRODUCTION

1.1. Background

The poor dwellers in Yaoundé and Douala living in informal settlements without ceiling have been facing challenges associated with the lack of indoor lighting during the day. The deployment of solar bottle bulbs can provide a sustainable solution to the day time lighting problems thus helping households to properly carry out their daytime main activities and tasks. This is going to enhance their lives from the social and economic points of view.

This report presents the process and output of a participatory operational survey which was conducted from 15 to 19 May, 2013. The survey aimed at obtaining relevant and adequate data on energy use during the day, habitants' attitude towards solar bottle initiative. The information generated is expected to form the basis for achieving the project planning and provide key observations for the project execution, project monitoring and evaluation

Over a period of 4 months the project targets to settle 4,000 solar bottle bulb amongst 3,000 informal settlement residents as well as having 6,000 of informal settlement residents aware of the benefits of solar bottle bulb

The Solar Bulb project will enhance the productivity of the beneficiary households by providing them with access to high quality day time lighting at no extra expense.

1.2. Objectives of the survey

The baseline survey is an integral part of the Solar Bulb project. The Framework envisages 4,000 informal settlement residents aware about the benefits of solar bulbs and 2,000 households installed by the end of June 2013.

The objective of the survey was to take a first measurement of these primarily indicators to ensure the successful execution of the project's activities.

An indicative list of key variables on which information is required is listed below:

- ⊕ Household member data (quarter's name, Name, Phone number).

- ⊕ What energy sources (CFL¹ bulb, incandescent light bulb, candle, battery torch, rechargeable lamp, solar lamp, cellular phone, and kerosene lamp) do the households in informal settlements currently use during the day for lighting and in what quantities? (The whole day, as need or a part time of the day) for the purpose of estimating energy consumption and expenditure.
- ⊕ Do households encounter any difficulties using the above mentioned energy sources? Are there activities that they are obliged to live out?
- ⊕ Entertainment (Local Press, TV and radio) where they gotten information for the purpose of media promotion.
- ⊕ Households' perceptions about success of solar bottle bulb and their willingness/reason to be settled.

2. SURVEY APPROACH & METHODOLOGY

2.1. Approach

A baseline survey is of great importance as it serves as guide in in efficient and effective planning, executing, monitoring and evaluation of a project. Thus a clear and mutual understanding amongst the project team over the project progress and performance and impact indicators is very necessary in order to obtain relevant and useful primary data.

The survey approaches was based firstly on a literature review that led to the gathering of socio-economic, demographic indicators, and infrastructure information. The information gathered during literature review guided us in developing criteria for the choice of informal settlement for both Yaoundé and Douala slum areas. Ten (10) slum areas were chosen and further survey was then conducted in these chosen slum areas.

2.1.1. Primary data collection tools

The following tools were developed for use during the collect quantitative and qualitative data by volunteers:

- ⊕ Urban slum profile (selection of survey sites).

¹ CFL: Compact Fluorescent Light usually named "economic light" in Cameroon

- ⊕ Household questionnaires.
- ⊕ T-shirts, portfolios and posters.

2.1.2. Sampling

At the end of the baseline studies 10 sites were surveyed; seven in Douala and Three in Yaoundé. The seven (07) quarters selected in Douala are *Dakar, Brazzaville, Bilongue, New Bell, Bonaberie, Village, and Bepanda* which happens to be amongst the 25 slums areas selected during the market research activity (low carbon energy project). The three quarters selected in Yaoundé are *Briqueterie, Emombo, and Vieux Panier*.

2.2. Survey methodology

2.2.1. Planning meeting with volunteers

Twelve (12) volunteers were motivated to conduct this survey during 5 days. Each volunteer had the task of recording 50 households per day willing to be settled within a few day. This approach was aimed at ensuring that at the end of the survey period, we should have identified 3,000 households ready to be installed as well as being sensitised on the benefits of solar bulbs.

Even though the Terms of reference of the survey was elaborate enough and explicit on the scope of work, before starting work on the aforesaid tasks, a planning meeting with volunteers was held a day before. During the planning meeting, FCTV project team leaders shared the field survey plan (checking and reviewing questionnaire, field materials) with volunteers and also made known what was required of the volunteers during this exercise.

2.2.2. Field survey

The field survey was directed and guided by a plan shared and submitted to the volunteers prior to their deployment. In Douala, two teams were formed and each team had to cover two deep specified quarters per day. In Yaoundé, just one team was formed. Members of these teams worked successively in the ten (10) selected quarters for 5 days.

The field survey consisted of the identification of informal settlements without ceiling and facing lack of indoor lighting during the day. Then volunteers had done proximity awareness raisings so called “door-to-door” on the benefits of solar bulbs as well as gathered information

about the households interested. Printed posters carrying information on to the solar bottle bulbs were put up in strategic places such as road junction, pubs, restaurants, and churches so that a wider number of people should be aware of the existence of such technology.



Figure 1: Field work

2.2.3. Analysis

All data will be entered into Sphinx to establish frequencies distribution, percentages and cross tabulation analysis of the key variables. The qualitative data obtained from all the respondents was analysed through content analysis. The method of analysis was by data reduction, data display and drawing. The qualitative data was organised and presented in various themes as per the study objectives

2.3. Challenges during the survey and discussion of limitations

On the first day of survey the volunteers who conducted the survey for at least 8 hours a day had difficulties identifying buildings having the required characteristics and also getting the willingness of the household members to be settled within 5 days. Thus making it difficult to attain the individual indicators mentioned in the sampling methodology. Faced with this reality, we decided to reduce the requirements from the previously agreed identification of 50 households to the identification of 35 households willing to be installed per day. The survey was continued in line with this new orientation.

The survey periods was short and worst of it all it was the rainy season. At times the volunteers were force to stop field by mid-day.

Many informal settlements were occupied not by head lessees rather by lodgers who were unable to make a decision about the installation of solar bottle bulb on their roof.

Some community members were not willing to cooperate with the volunteers as they did not believe in the initiative. They considered the survey was futile and thought they will have no follow up.

3. HOUSEHOLDS SURVEY FINDINGS

3.1. Households responses

3.1.1. Potential beneficiaries

From the survey it was gotten that 1,665 households out of the 1,669 surveyed present the problem of lack of indoor lighting during the day, thus meeting the requirements of being considered project beneficiaries. Find indicated in the figure below

NB: Amongst the 1,669 households interviewed, just 4 (from Douala) don't have any trouble during the daytime. All of them are lightened by the ambient light.

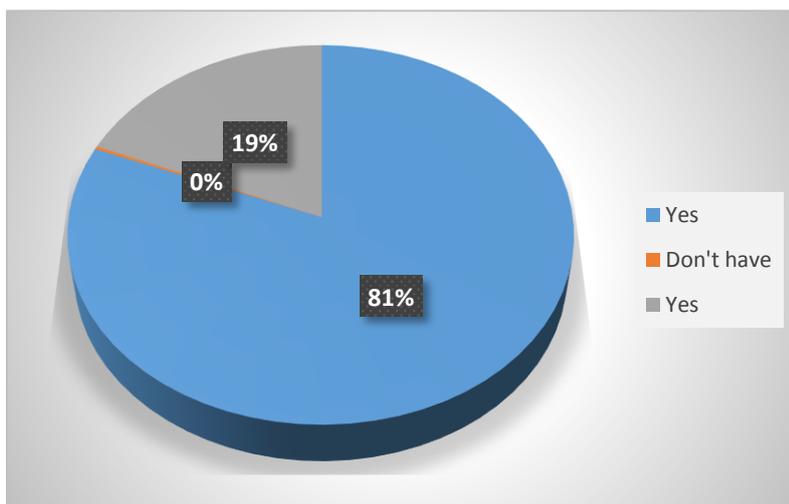


Figure 2: Potential Beneficiaries

3.1.2. Level of demands

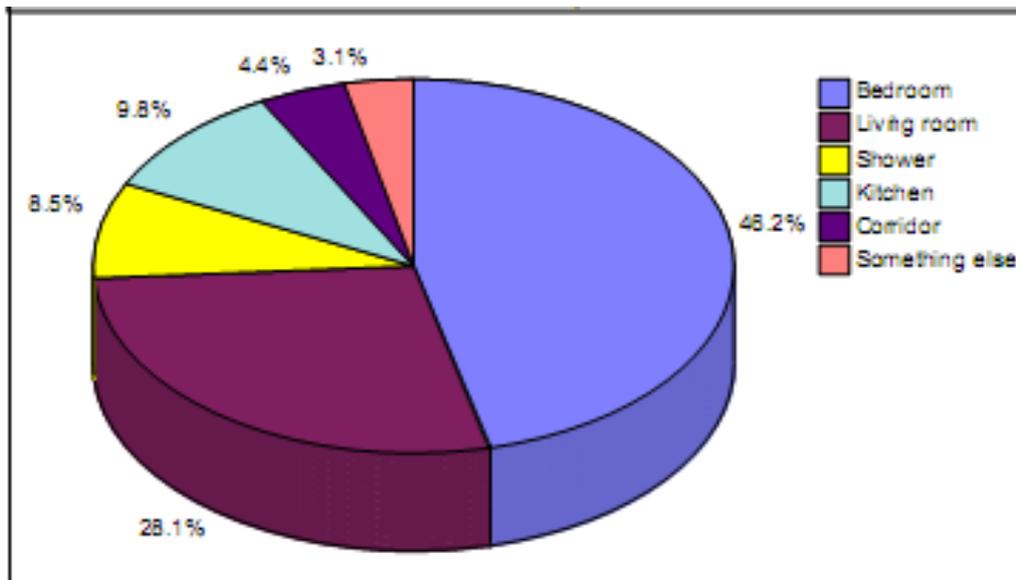
The table below provides the level of demands grouped by the range of needs separately in Douala and Yaoundé. For instance, there is a households which has 15 rooms that needs to lighted by solar bottle

Table 1: Level of demand

DOUALA			YAOUNDE		
Number of rooms	Households per number of rooms	Total	Number of rooms	Households per number of rooms	total
15	1	15	12	1	12
12	4	48	11	1	11
11	2	22	10	5	50
10	13	130	9	5	45
9	13	117	8	9	72
8	28	224	7	12	84
7	34	238	6	11	66
6	87	522	5	29	145
5	124	620	4	41	164
4	180	720	3	50	150
3	263	789	2	63	126
2	325	650	1	85	85
1	279	279			
0	4	0			
93	1357	4374	78	312	1010

Key comments

As specified in this table above, the demand is quite amazing. Of the **1,665 households** in informal settlements identified, there are **5,384 rooms** that suffering from a lack of indoor lighting during the day.



3.1.3. Type of rooms

Figure 3: Number of demand per type of room in Douala

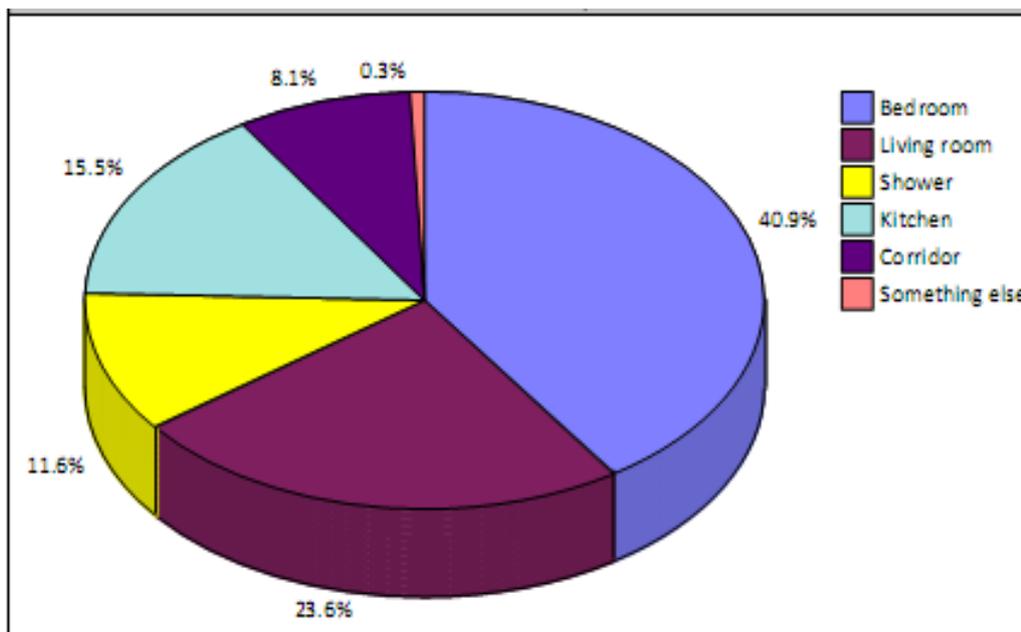


Figure 4: Number of demand per type of room in Yaoundé

Key comments

To ease the understanding of the information displayed on this graph: 46.2% of demand is for lightened bedrooms (Case of Douala).

Withing “**something else**”, We have grouped some other unusual rooms and here you’ll see the result for both Douala and Yaoundé.

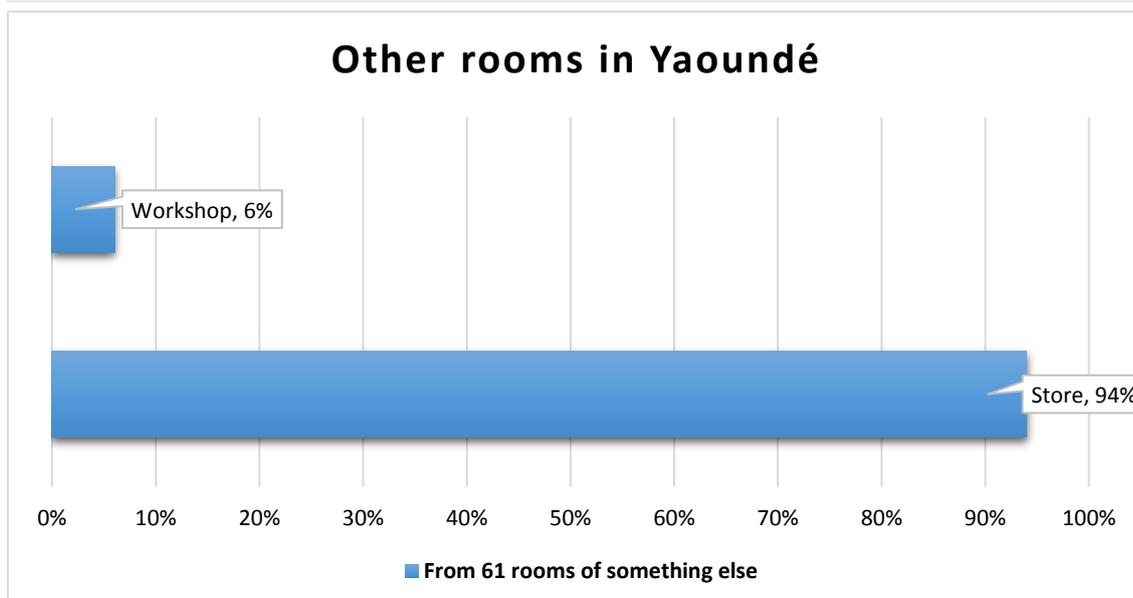
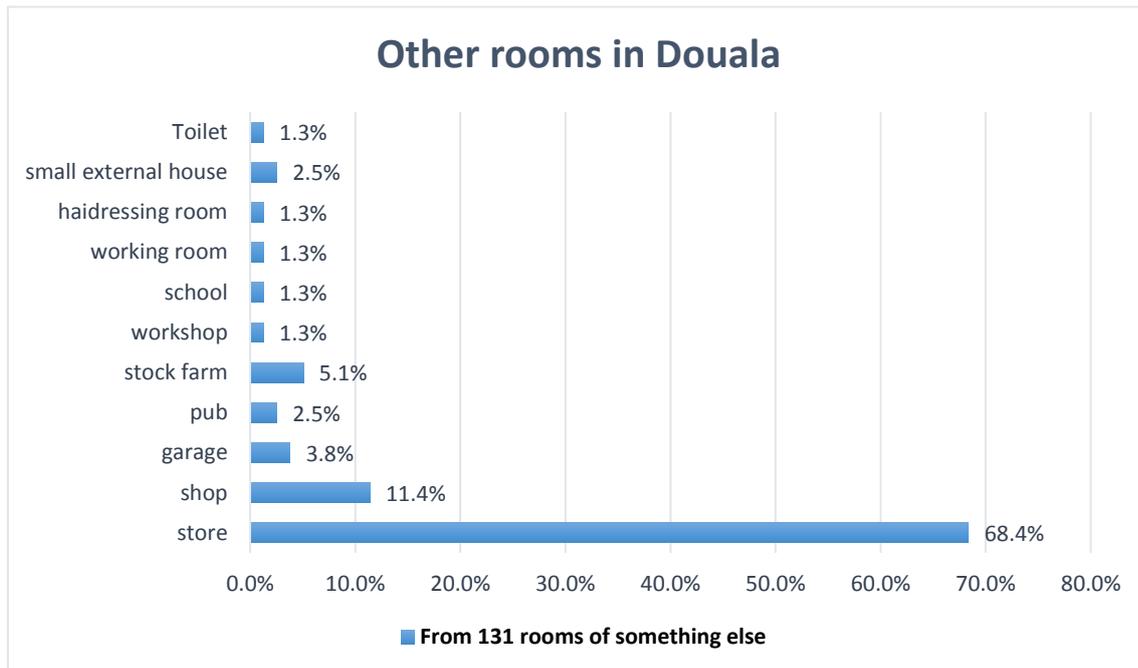


Figure 5: Other rooms

Key comments

We can observe the high level of recurrence of stores both in Douala and Yaoundé.

3.2. Expenditure and usage of Energy sources

3.2.1. Available of energy source and usage

The available energy sources at present include CFL bulb, incandescent light bulb, candle, battery torch, rechargeable lamp, solar lamp, cellular phone and kerosene lamp.

According to the survey result, CFL bulb is the most used form of source for lighting (by 46.6% of the households) in Douala while the most used in Yaoundé is incandescent light bulb which around 61.2% during the daytime. Find information on the different energy sources used in Douala and Yaoundé in the table below.

Table 2: The use of energy sources

SOURCE	DOUALA	YAOUNDÉ
CFL bulb	46.6%	18.8%
Incandescent light bulb	45.7%	61.2%
Candle	0.6%	10.8%
Battery torch	1.2%	1.3%
Rechargeable lamp	0.4%	1.1%
Solar lamp	0.2%	0.3%
Cellular phone	1.5%	6%
Kerosene	0.8	0.5%
Use nothing	3%	0.0%

3.2.2. Evaluation of the average household monthly expenditure

3.2.2.1. Assumptions

The household average monthly expenditure on energy sources was considered under three levels of time usage of energy source (*all day, as need, and a part time of the day*). These assumptions concern CFL bulb, incandescence light bulb, candle, and kerosene lamp.

We have assigned a value for each level of usage as listed below:

Table 3: Energy source consumption's assumptions

CRITERIA	VALUE	COMMENTS
All day	6 hrs.	If a household chose all day, this suppose that he uses this selected sources during 6 hours per day
As need	30 min	If a households chose as need, this suppose that he uses this selected source during 30 min per day
A part time of the day	2 hrs.	Use the selected sources during 2 hrs. per day

These assumption will help to estimate bill cost saving through the use of one solar bottle bulb for lighting a room during the day.

3.2.2.2. Households' main energy sources settling and purchase prices

a) Purchase prices

The figures outline here are proceed from Douala's hardware stores such as Quiferou (considered by inhabitants as the famous cheapest store of Douala), retail hardware stores.

Table 4: Energy source purchase price

SOURCE	Cost (\$)
CFL bulb	0.5
Incandescent light bulb	0.5
Candle	0.2
Battery torch	3 (minimum cost)
Rechargeable lamp	6 (minimum cost)
Solar lamp	24 (minimum cost)
Cellular phone	11 (minimum cost)
Kerosene lamp	6 (minimum cost)

According to this table, a deeper analysis must have to be done by comparing solar bottle bulb settling cost against light bulbs (CFL bulb and Incandescent light bulb) and candle settling costs because their purchase price is less than \$2. The purchase prices of the other technologies are already large and a deeper analysis will just drive to increase those prices and don't provide useful information. In fact for instance a battery torch often needs two batteries at \$0.4 per battery and last three months depending on the level of use. Therefore at the early stage we spend \$3.8, then \$0.8 at least every three months.

b) Lighting source settling cost

i. Light bulbs

For both CFL bulb and Incandescent light bulb, there is a need of connection to the grid which require $2 \times 1.5 \text{ mm}^2$ (phase and neutral hardwires) and depending to the required length (from meter to a room) which is often 5 meters at \$0.2 per meter. This also requires a socket which cost \$0.4 as well as a switch which cost \$0.6. For settling a light bulb by laying along hardwires from energy origin (meter) to a room, the installation fee is often estimated at \$6 because since we're handled with dwellers in informal settlements and then might rarely require breaking the wall and roughcasting it.

We considered that the technician has the technical material to do the work as usual, as well as the power origin (meter) has already be installed.

In conclusion the settling cost of a light bulb is around \$9 and due to the low quality of light bulbs in the market, we might need to replace it five times over every year.

ii. Candle

This solution is the easiest, least (light quality) costing energy source for lighting. It simply requires any kind of support (ground as well). So this is the cheapest lighting energy source, but while using this energy source we're at risks such as fire incidence, light body burns.

iii. Sola bottle bulb

The settling cost and installation fee of a solar bottle bulb is about \$2. Unfortunately, this gadget cannot be used during the night as the others (including the other lighting sources set aside because of theirs high purchase prices).

c) Summarise

Solar bottle bulb is the most economic (after candle) and the most sustainable solution for lighting during the day in informal settlements. It possesses a good spread light quality as a CFL bulb compared to candle, battery torch, and kerosene lamp.

3.2.2.3. Households' main energy source consumptions

a) CFL bulb

In Douala by using a solar bottle bulb instead of a CFL bulb for lighting a room, a household will save **\$0.2 per month**. While in Yaoundé, he will save **\$0.1 per month**.

b) Incandescent light bulb

In Douala by using a solar bottle bulb instead of an incandescent light bulb for lighting a room, he will save **\$0.3 per month**. While in Yaoundé, the household will save **\$0.2 per month**.

c) Candle

In Douala by using a solar bottle bulb instead of a candle for lighting a room, he will save **\$1 per month**. While in Yaoundé, the household will save **\$2 per month**.

3.2.2.4. Synthesis

Table 4: Unit energy source comparison (daytime)

Classification 1 st Solar bottle bulb, 2 nd Candle, 3 rd CFL bulb, 4 th Incandescent light bulb	CFL bulb		Incandescent light bulb		Candle		Solar bottle bulb	
	Douala	Yaoundé	Douala	Yaoundé	Douala	Yaoundé	Douala	Yaoundé
Purchase price (\$)	0.5	0.5	0.5	0.5	0.2	0.2	-	-
Settling cost (\$)	9.0	9.0	9.0	9.0	0.0	0.0	2.0	2.0
Average Operational cost (\$/month)	0.2	0.1	0.3	0.2	1	2	0.0	0.0
Total Expenditure after two months	9.9	9.7	10.1	9.9	2.2	4.2	2.0	2.0

This table also helps to have an idea of expenditures for a mix energy sources using.

Douala case

Table 5: CFL light bulb - Douala

CFL bulb	Time usage	Unit (hrs.)	Recurrence ²	Total time usage (hrs.)	Unit power (W)	Energy (KWh)	Cost of KWh (\$)	Total cost per day (\$)	Total cost per month (\$)	Use unit ³	Expenditure per dweller (\$)	Cost saving ⁴
	All day	6	1081	6486	22	143	0.1	14.3	428.1	317	1.35	\$0.2 per light bulb
	As need	0.5	459	229	22	5	0.1	0.5	15.1	188	0.08	
	A part time of the day	2	422	844	22	19	0.1	1.9	55.7	227	0.25	

Table 6: Incandescent light bulb - Douala

Incandescent light bulb	Time usage	Unit (hrs.)	Recurrence	Total time usage (hrs.)	Unit power (W)	Energy (KWh)	Cost of KWh (\$)	Total cost per day (\$)	Total cost per month (\$)	Use unit	Expenditure per dweller (\$)	Cost saving
	All day	6	196	1176	50	59	0.1	5.9	176.3	83	2.12	\$0.3 per light bulb
	As need	0.5	1236	618	50	31	0.1	3.1	92.7	453	0.20	
	A part time of the day	2	228	455	50	23	0.1	2.3	68.3	183	0.37	

² Recurrence referred to the number of sole appearances of a source of energy multiply by a correlation coefficient (with consider the other mix appearances of the source). This is purely a statistical analysis

³ This only reference to the number of mix appearance of an energy source. This help to estimate the expenditure cost per time usage

⁴ Cost saving per month referred to the estimating of the amount of cost we can serve by using a light bulb to lighting a room independently of the time usage.

Table 7: Candle - Douala

	Time usage	recurrence	Level of usage	Unit cost (\$)	Total cost per week (\$)	Total cost per month (\$)	Use unit	Expenditure per dwellers (\$)	Cost saving
Candle	All day	0	2 candles per week						\$1 spent per month to light a room
	As need	11		0.2	4.40	17.6	3	5.87	
	A part time of the day	1		0.2	0.4	1.6	2	0.53	

Yaoundé case

Table 8: CFL light bulb - Yaoundé

	Time usage	Unit (hrs.)	Recurrence	Total time usage (hrs.)	Unit power (W)	Energy (KWh)	Cost of KWh (\$)	Total cost per day (\$)	Total cost per month (\$)	Use unit	Expenditure per dweller (\$)	Cost saving
CFL bulb	All day	6	14	84	22	1.8	0.1	0.18	5.54	8	0.69	\$0.1 per light bulb
	As need	0.5	109	54	22	1.2	0.1	0.12	3.58	60	0.06	
	A part time of the day	2	11	21	22	0.5	0.1	0.05	1.39	4	0.35	

Table 9: Incandescent light bulb - Yaoundé

	Time usage	Unit (hrs.)	Recurrence	Total time usage (hrs.)	Unit power (W)	Energy (KWh)	Cost of KWh (\$)	Total cost per day (\$)	Total cost per month (\$)	Use unit	Expenditure per dwellers (\$)	Cost saving
Incandescent light bulb	All day	6	0	0	50	0	0.1	0	0	-	-	\$0.2 per light bulb
	As need	0.5	603	301	50	15	0.1	1.51	45	215	0.21	
	A part time of the day	2	38	75	50	4	0.1	0.4	11	16	0.71	

Table 10: Candle - Yaoundé

	Time usage	recurrence	Level of usage	Unit cost (\$)	Total cost per day (\$)	Total cost per month (\$)	Use unit	Expenditure per dwellers (\$)	Cost saving
Candle	All day	9	1 candles per day	0.2	1.8	54	5	11	\$2 spent per month to light a room
	As need	13		0.2	2.6	78	35	2	
	A part time of the day								

3.2.3. Key challenges faced when using the actual energy source

Findings proved that amongst the 1,357 households interviewed in Douala, only 7.2% have heard that the use of candle and hazardous safety standards of illegal connections (short circuit) have being the reason behind fire accidents. And 0.8% of them implicated the use of kerosene lamp behind poisoning occurrences. In Yaoundé the survey did not reveal any information on this.

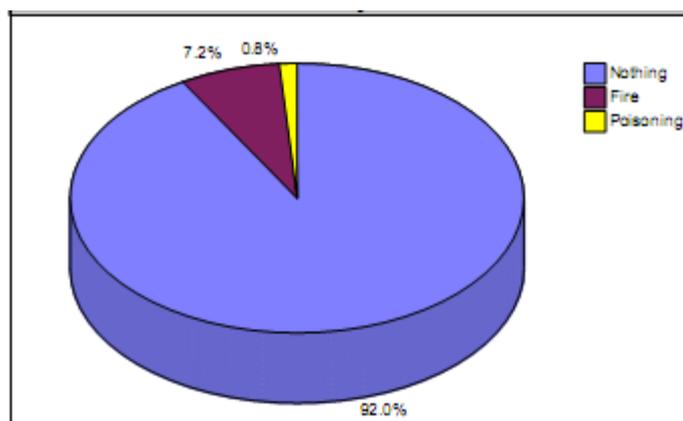
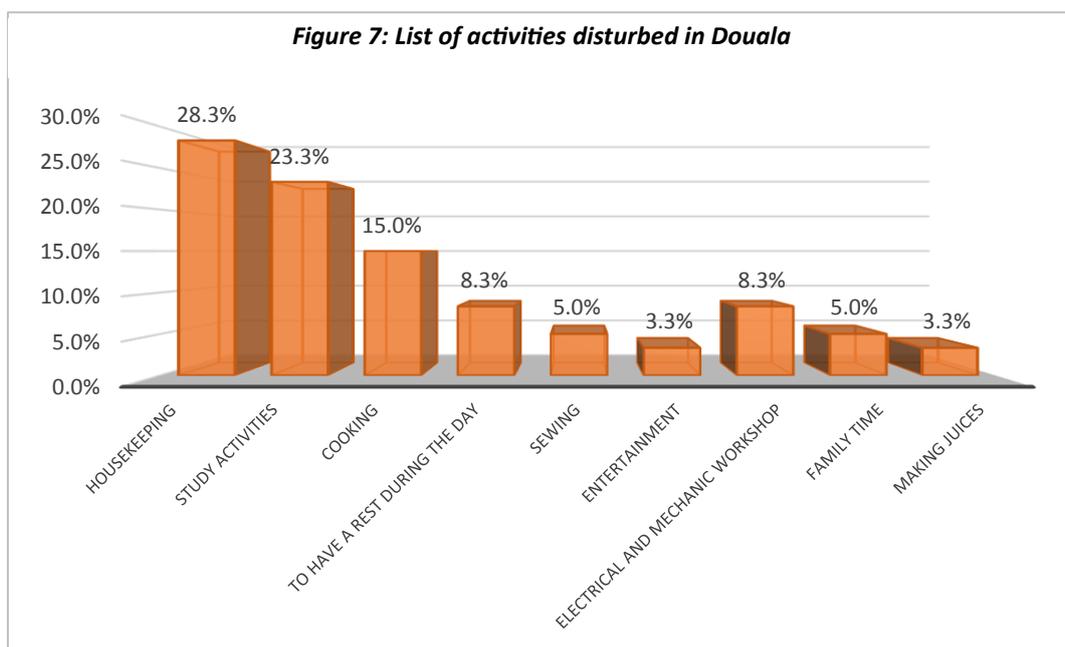


Figure 6: Trouble encountered

On the other hand, due to lack of indoor lighting during the day, households in informal settlement had difficulties to carry out their activities or tasks. The figure below illustrated this statement

Table 11: Level of difficulties encountered

City	Response	Number of occurrence	Frequency
Douala	No trouble	1,297	95.6%
	Trouble	60	4.4%
Yaoundé	No trouble	310	99.4%
	Trouble	2	0.6%



In Yaoundé, the problem mentioned by those two households was related to **study activities**.

3.3. Community perception/views about solar bottle bulb

There is a strong willingness amongst those surveyed to opt for solar bottle bulb as an alternate source of energy for their houses. Results after data analysis portray the level of willingness quantified in percentage is 97.6% and 99% for Douala and Yaoundé respectively.

68% of the households surveyed in Douala and 70% in Yaoundé do perceive that solar bulb is cost efficient, it's a healthier source of energy and also resolves the problem of the lack of indoor lighting during the day.

Table 12: Willingness to opt for solar bottle bulb

Willingness	Douala	Percentage	Yaoundé	percentage
Yes	1,325	97.6%	309	99%
No	28	2.0%	3	1.0%
Don't know (no have a problem)	4	0.4%	0	0.0%
Total	1,357	100.0	312	100.0

3.4. Entertainment

The findings proved that most of the households in informal settlements do get information through Local traditional media particularly TV, with 88.9% in Douala and 85.6% in Yaoundé.

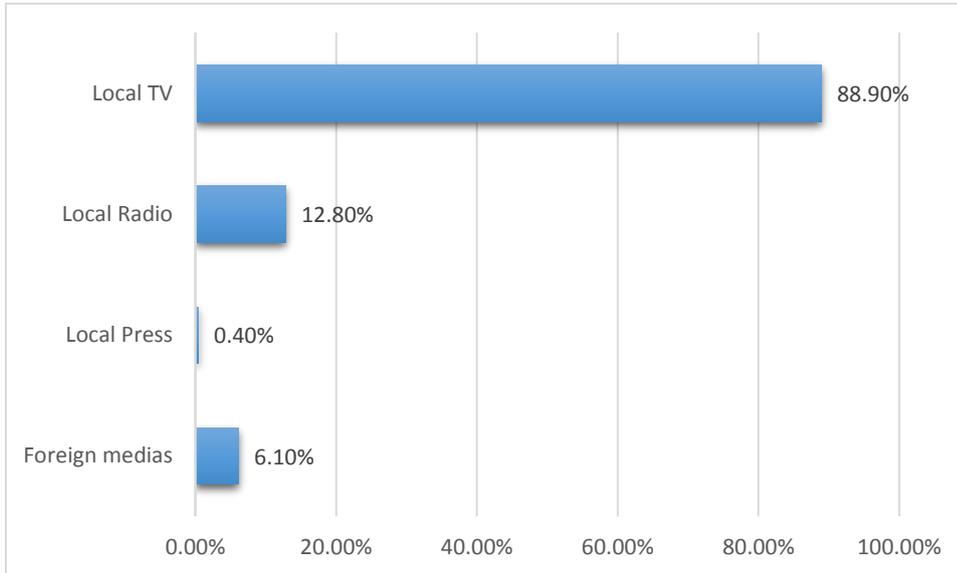


Figure 8: Traditional mass media listening rate in Douala

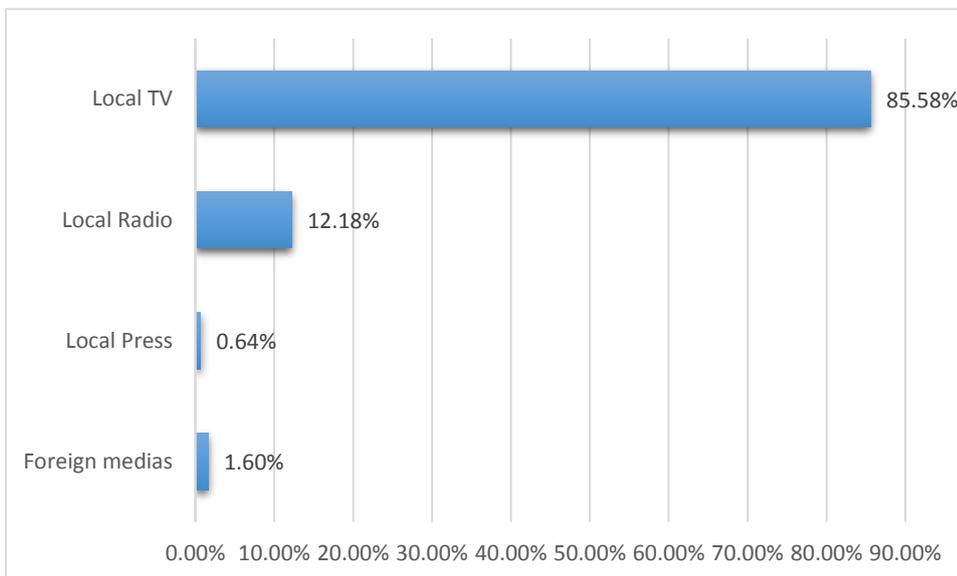


Figure 9: Traditional mass media listening rate in Yaoundé

Of the numerous mass media, we have listed the most relevant and competent to carry on with the campaign that will be carried out in both in Yaoundé and Douala.

Table 13: Media recommended for the project

Type of media	Douala	Yaoundé
Local TV	Canal 2 and CRTV	Canal 2 and CRTV
Local radio	Equinoxe and Balafon	CRTV radio and FM 94
Local press	Le Messenger and Nouvelle expression	Cameroun tribune

4. CONCLUSIONS & RECOMMANDATIONS

4.1. Conclusion

In a nutshell, both in Douala and Yaoundé most of the occupants household of the informal settings expressed strong interest and willingness to opt for solar bottle bulb technology. Some of them are enthusiastic to see the project activities continue and also ready to participate in any training organized in this regard.

4.2. Recommendations

- ⊕ Once the gadgets have been installed, the household should be made responsible for their overseeing for better results and better sustainability.
- ⊕ In order to enable the maximum number of informal settlement to participate in project, it is recommended that the volunteers who will receive training be grouped as one more informal/formal Common Initiative Groups. With this status they can in the future receive incentives from the other interested dwellers prior the installation.
- ⊕ Because there is still need to emphasis more on awareness raising, on the use of solar bulb and its economic and ecological benefits. Because of the restriction of budget, we can simply multiply the number of advertising posted beyond the surveyed sites, thus more inhabitant can be tapped into.