Electrification of the Manoka district hospital with solar energy

Project objective: contribute to economic and social development of a rural community through electricity provision

Location: Manoka district, Littoral region, Cameroon.

Beneficiaries: Inhabitants of Manoka

Total cost : **16 954 000 (XAF)**

Funding needed: **14 974 000 (XAF)**

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Summary

Lumiere Pour Tous was contacted by the parish priest of Manoka for assistance to electrify the Manoka District using solar energy. Electrification of this community would lead to an economic development and consequently the livelihoods of the inhabitants. Lumiere Pour Tous sent a team to the community to collect data that would permit to carry out a pre-study to determine if the location and needs of the district meet the criteria set out by the association for assisting in the electrification of communities. This project was selected based on the following criteria:

- Urgent health and social needs;
- Population density;
- Distance of the community from national electricity distribution grid;
- Agreement with the local authorities ensure the sustainability of the solar installation after project execution.

A detailed study was carried out by the technical team of Lumiere Pour Tous - team of engineers experienced in the field of rural electrification. This study included the sizing of the installations, the financial arrangement, the planning and the life cycle analysis of the project.

This document will be made available to all stakeholders (companies, diplomatic representations, foundations, development agency, etc.) who can contribute to the realization of the project.

Content

I. Lumiere Pour Tous

« Lumière Pour Tous » is an association created subject to the law of July 1, 1901 and the decree of August 16, 1901 registered in France with the creation number *W772009317* and also subject to law no 90/053 of December 19, 1990 relating to the freedom of the association, registered in Cameroon with the creation number *00000144 / RDA / JO6 / SAAJP / BAPP*. It is a non-profit association with objective to promote the use of renewable energy to increase access of rural and remote communities to electricity and to sensitize companies on the efficient management of electric energy.

The association's activities include :

- Organising fundraising events;
- Designing and realising energy power plants such as mini wind power plant, mini solar power plant);
- Training a team from the local population to ensure sustainability and adequate operation of realised projects;
- Design and build boreholes using solar energy for access to drinking water;
- Promote energy savings in companies and raise awareness on the efficient management of energy.

The association has a team with both technical and managerial skills capable of handling projects from the conception to implementation phase and meeting the associations commitments to the different partners. The association has successfully completed several projects in Cameroon some of which include:

- Electrification of the Bafou health center in the Menoua Division;
- Electrification of the Bangou health center in the Hauts-Plateaux Division;
- Electrification of the Dja-Bandjoun district hospital in the Koung-Khi Division;
- Electrification of the Mouanko district hospital in the Sanaga Maritime Region.

II. Relevance of the projet

2.1. Context

Electricity is an essential need, which is required to foster the economic development of many communities and countries. With the advent of renewable energy and considering that Cameroon is blessed with an abundance of sunshine throughout the year, the country could benefit from solar power electricity plants. However, most of its rural population, does not have access to electricity. This is the case of the Manoka district.

Manoka is the largest island in Cameroon, with an area of 3650 km^2 and 40,000 inhabitants – out of which 80% are Nigerian and Malian expatriates and 20% are Cameroonians. The density of this island is 35 inhabitants per km^2 with a total of 45 camps and 24 islets.
The people of Manoka are one of the poorest in Cameroon and live in precarious conditions. Electricity is one of the essential needs that the people of Manoka do not have access to. This causes the following problems:

- A low school attendance rate and consequently an increase in the illiteracy rate;
- Increase in social inequalities ;
- Precarious and degraded sanitary conditions;
- Promiscuity.

2.2. Problem to solve

Due to the poor connection between the district of Manoka and the city of Douala – where the major health facilities are located, the electrification of the Manoka district hospital will help improve the living conditions of the inhabitants. Specifically, the electrification of the Manoka District Hospital would:

- improve night-time interventions;
- improve the storage of vaccines;
- improve delivery conditions and surgical procedures;
- improve the working and living conditions of health personnel.

2.3. Maintenance of the installation

The sustainability of the installation is one of the organisations priorities. Considering that this is one of the major challenges in these types of projects, the organisation would ensure the sustainable of the project by providing a technical training to the local population to ensure they have the adequate technical - and possibly the financial - support to ensure optimal profitability and continous operation of the installation.

An amount of two million is foreseen in the budget to allow the possible repairs of the equipment during the next ten years. This amount will be kept and managed by the association. During the project implementation, a team from the local population will be trained to take care of the routine maintenance of the equipment and the association can be contacted in case of a major breakdown of the installation, which cannot be handled locally.

The municipality of Manoka also provides some self-financing actions in the operating budget of the hospital where a specific part of the budget is reserved for the maintenance of the installation and the replacement of small equipment such as light bulbs for example. Currently the villagers walk three hours to recharge their cell phones, it is forseen to provide a small elextric box outside the hospital that would allow charging upto ten mobile phones at a time.

The association intends to set up a monitoring committee made up of local stakeholders (doctors, nurses, midwife, mayor, municipal councilor, villagers, etc.) who could take over and regularly monitor the development of the facility. This committee will ensure the continual operation of the installation once the project is completed. The completed work will become the property of the district town hall and the population will be able to use it free of charge. The mayor of the district will be responsible for the administrative work.

III. Project characteristics

3.1. Inventory and power requirements

To assess the total power required and consequently an accurate sizing of the installation, an inventory of the hospital's electrical equipment was carried out. This data is shown in Table 1 and is used to carry out the power balance necessary for the sizing of the solar panels and the batteries.

Désignation	Power [W]	Quantity	Total power [W]	Time of use [h]	Energy consumption per day [Wh/day]
Lighting	18	35	630	8	5040
Computer	300	3	900	8	7200
Table centrifuge	600	1	600	4	2400
Binocular microscope	20	3	60	4	240
Refrigerator	450	1	450	12	5400
Two-jar surgical suction pump	230	2	460	3	1380
X-ray viewer	80	3	240	3	720
Television + decoder	80	2	160	15	2400
Total			3500		24780

Table 1: Power electric review

Weather data was obtained from the info climat website as this is necessary for the sizing of the panels and the assessment of the life cycle of the project. The amount of sunshine is used to measure the productivity of solar panels. For this project, the rate of sunshine is favorable to

produce sufficient electricity throughout the year i.e. on average more than 120 hours of sunshine per month in the district of Manoka.

Mois	Jan	Fév	Mar	Avr	Mai	Juin	Jui	Aoû	Sep	Oct	Nov	Déc
Min (°C)	23	24	24	24	23	23	23	23	23	23	23	23
Max (°C)	32	33	33	32	31	30	28	28	29	30	31	32

Table 2: The average temperatures recorded in Manoka [1]

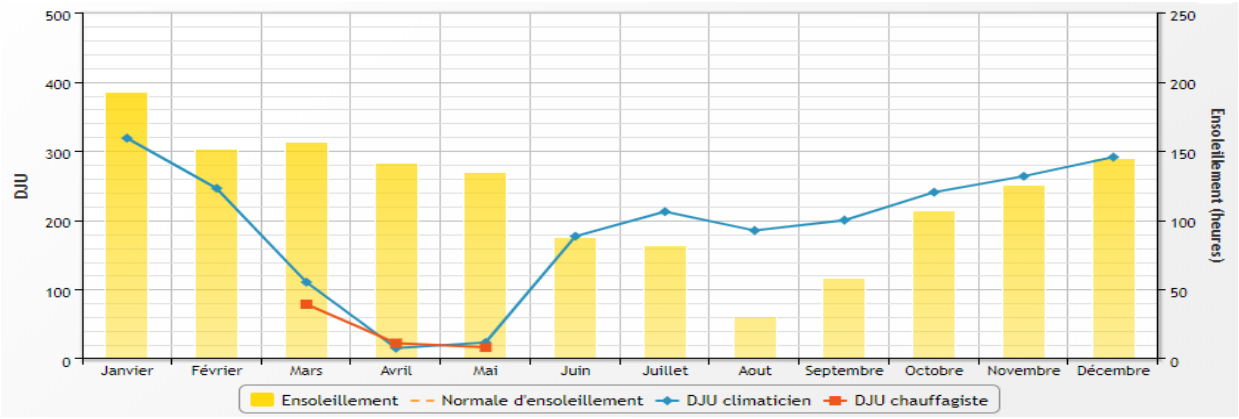

Figure 1: sunshine in Manoka[2]

3.2. Project studies and costing

The project takes the form of an Independ Power Producer (IPP) relating to its design, financing, construction, operation and maintenance of a solar power plant with a power of 4.5 kWp. This plant will be developed on an area of approximately 60 m2 square meters. It will have a storage capacity of one day at full power, which will allow meeting the energy demand even when the sun is not shining. This phase of the project will start depending on when funding is available although it is foreseen to start in February 2021.

Based on the power balance, forecasts of electrical energy consumption at the Manoka District Hospital and the amount of sunshine, a choice of an installation consisting of 18 panels of 250Wp / 12V, on an inclined plane as shown in Figure 2. This dimensioning corresponds to a storage capacity of 24 GEL 200Ah batteries. In addition, a SOLAR KIT – see Table 3 below - to accompany the batteries and solar panels.

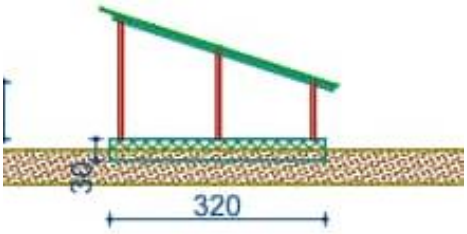

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Figure 2: Solar panel configuration

Solar KIT	KSAC450			
	Specification	Quantity	Unit price [FCFA]	Total price [FCFA]
Solar equipment				
Solar panels	250Wc/ 12V	18	200 000	3 600 000
Charge controller	PWM100A/48V	1	550 000	5 50 000
Battery	GEL 200Ah	12	250 000	3 000 000
Inverters	5000/48V	1	1 100 000	1 100 000
Sub total solar equipment				***8 250 000***
Installation support				
Box of batteries	BKSDC50- 2P+T	1	240 000	240 000
Support for fixing solar panels	Barre de rail	1	500 000	500 000
Sous-Total Supports				***740 000***
Cabling DC&AC				
Panel cables	Souple 1*10mm²	60	2 000	120 000
DC box cable-controller-batteries-inverter	Souple 1*16mm²	30	3 000	90 000
Cable-controller-battery-inverter	1*25mm	20	5 000	100 000
AC cable for connection	VGV 3*4mm²	50	1 500	75 000
Subb-total for cabling DC&AC				***385 000***
Protection DC&AC				
DC box	Disjoncteur+ Fusible	1	350 000	350 000
Battery switch	-			0
AC box + power limiter	-			0
Grounding				100 000
Sub total Protection DC&AC				***450 000***
Accessories				
Connectors MC4	Paire Simple	4	0	0
LED 1,20		35	9000	315 000
Ringed sheath				0
Other accessories	Mails, screws, tape, …	1	360 000	360 000
Sub-Total of installation accesories				***675 000***
Cost of KIT in FCFA				**10 500 000**
Labour cost		1	2 974 000	2 974 000
TOTAL				13 474 000

3.3. Planning

The project is scheduled to run for a period of 18 months as shown on Table 4. This period does not include the time that has been used to carry out the feasibility study. The critical task is that of fundraising, because this project is solely dependent on the generosity of donors and businesses. Given the current economic situation, linked to the pandemic, the search for funding might take longer than expected. Moreover, the second planning risk is the installation of the system, as access to Manoka is only by river.

Activities	Duration	Planning								
feasibility study	2 months									
fundraising	6 months									
choice of providers	2 months									
obtaining the building permit	2 months									
system installation	4 months									
observation and commissioning	2 months									
staff training	2 months									
control and inspection	6 months									

3.4. Project partners

The association has experience in the installation of solar-based power plants in rural areas and relies on the skills of its experienced members and graduates, specialized in solar energy and sustainable development. This team is heterogeneous because it also includes project managers and finance, necessary to oversee all the activities necessary to ensure the project is realised.

Name	Post	Role	Education
Steve FOPPA	President Lumière pour Tous, France	Project management engineer	Holds a master's degree in energy physics and energy transition from Paul Sabatier University in partnership with EDF, and a master's degree in mechanical engineering from the University of Maine, France.
Eric FOTSO	President Lumière pour Tous, Cameroon	Project manager	Holds a master's degree in energy and environmental engineering from the National Advanced School of Engineering – Polytechnique Yaounde. Currently doing a PhD in pysical sciences at the Uniersity of Douala
Réa Ayimélé Tsopfack	Accountant	Electrical engineer	Holds a masters in energy and National Advanced School of Engineering – Polytechnique Yaounde.
Thecle YEPJOUO	Treasurer	Financial management engineer	Holds a professional masters in accounting, control and audit from the Catholic university institute Saint Jerome, Douala.
Alex FOTIÉ	Assistant mission manager	Assistant project manager	Specialist in solar thermal and solar energy

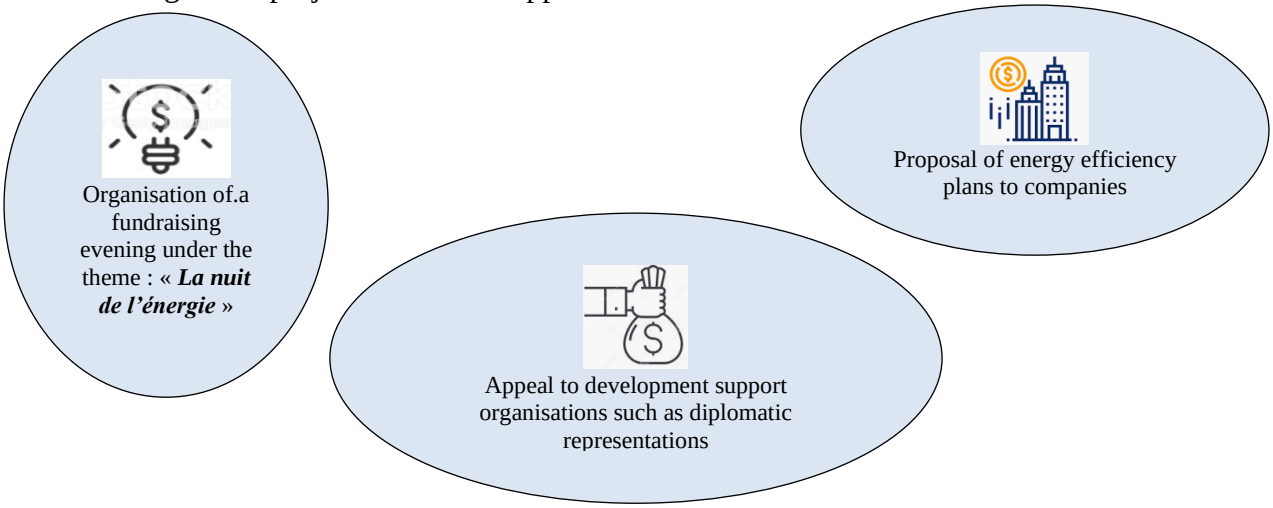
IV. Finances

4.1. Expenditure breakdown

		Montant en XAF
Realised budget		**1 080 000**
Feasibility studies	Carried out by a team of engineers, this study lasted for a period of 40 days. Each engineer was paid 20000 FCFA per day.	800 000
Transportation	Travel done mainly by water/river	100 000
Documentation	A report was made to clearly document the work done by the teasibility study team	180 000
Trainings		**900 000**
Media communication	Purchase of time slots on populat TV and radio stations to publicise the project.	400 000
Other costs	• Awareness/sensitization campaigns • Maintenance cost for the associations equipment used • Other unforeseen costs	500 000
Required funds		**14 974 000**
	Electrification of the distric hospital	13 474 000
Inspection and control	Study conducted by an independent firm to ensure that the installation to be put in place complies with the legal specifications.	1 500 000
Global project cost		**16 954 000**

4.2. Funding

The funding of the project takes three approaches :



4.3. Potential risks and setbacks

The main risk of the project is essentially linked to the pandemic as it has lead to an economic crisis. Since realsing this project depends mainly on the generosity of companies and private donors this is a major challenge. To limit this risk, the association has diversified the funding sources as discussing in Section 4.2 above. Also, access to Manoka is only by river, and this represents a risk to the progress of the works in the event where there are no boats available for transport or the river is overfloaded. To mitigate this risk, the association has already taken steps to discuss with the individuals operating the boats to Manoka.

Annexe

1. https://www.climatsetvoyages.com/climat/cameroun
2. https://www.infoclimat.fr/climatologie/annee/2017/douala-obs/valeurs/64910.html

Figure 3: The arrangement of solar panels of the inclined plane