

Fundraising for photovoltaic systems in Benin



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September 2013 – March 2014

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1. Project in a few words:

The installation of photovoltaic systems in developing countries may seem utopian and non-priority. But for a country grows, the access to electricity must be ensured. This is not the case for Benin with only 5% of households in rural areas with an access to electricity. This country has a great potential for development through a common desire of the government to improve the quality of life.

The NGO “Pont Universel (PU)” gives the opportunity to Swiss citizens with the wish to meet another culture to share their knowledge in a humanitarian goal. This NGO proposed to the student Quentin Cavillier, for his Master thesis to EPFL (Federal Polytechnic School of Lausanne), to supervise one project. The necessity to transmit knowledge and promote sustainable electrical systems in countries that currently have a great need for new energy sources is the reason of this project. The installation of photovoltaic systems in four villages, Lahotan, Gobada, Coco and Djagballo located in Savalou and Bante will show to local people the benefit of electricity production with renewable energy. A public awareness on the maintenance and security of systems will ensure the sustainability of their use. A second objective is to demonstrate the potential of these technologies in the long term in order to unlock more funds for the installation of similar systems.

To maintain systems, we will give the possibility to the local population to recharge their electrical device for a contribution of 0.1 CHF. A management committee will guarantee the proper use of funds provided by income.

The costs for the purchase of this equipment are amounted to **37'000 CHF**. This project is supported and supervised by three NGO. The NGO “Electriciens sans frontières” provided 15'000 CHF worth of electrical material because of their partner EDF, Legrand and Nexans. The NGO “Pont Universel” supervises the student M. Quentin Cavillier who is in charge of the electrification of the four villages. The NGO “Action Benin Solidarité” is responsible for logistical support to Benin.

The only condition to receive the material of ESF is to collect 22'000 CHF ensuring the sustainability of the project.

Funds collected actually are two donations of 5'500 CHF (4'500 euros). **We give the possibility to our contributors to be the only financial partner of the electrification of one village against a donation of 5'500 CHF.** We want to separate donations per village to return a clear description of our expenses to our contributors. For each village, a report with pictures on impacts of these systems on local population will be written.

Another possible way is to finance only one installation with a donation of 2'000 CHF (for example, the dispensary of Lahotan).

In conclusion, we would still find funds worth 11'000 CHF (9'000 euros) before January.

The following report describes photovoltaic systems of one, Lahotan, of the four villages. Systems of the three other villages are similar as those of Lahotan.

2. Current conditions in Benin:

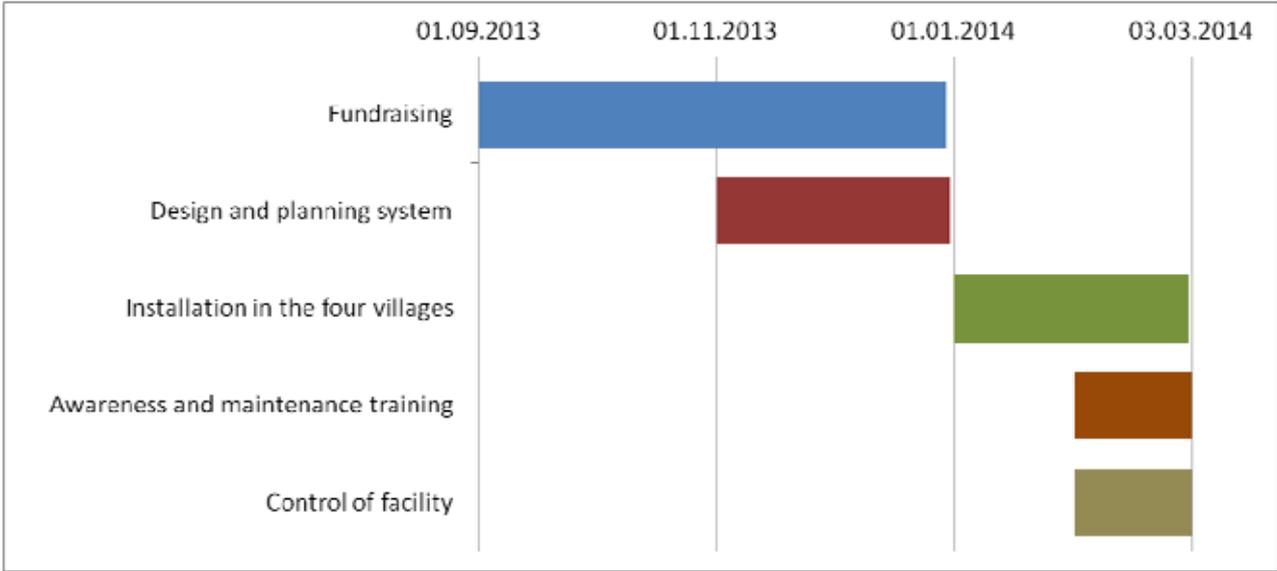
Benin is a country with an exemplary policy in West Africa. The implementation of a democracy and a constitution in 1990 has allowed an important social and economic development with, for example, the introduction of compulsory schooling. A major problem in Benin is the supply of electricity which greatly hinders its development. Benin currently produces only 10% of its electricity consumption. The electricity imported from neighboring countries is unreliable, such as Nigeria, the network is suffering from frequent power cuts. Some studies have shown that access to electricity varies from 80% in coastal cities to 5% in rural areas with an average of 22% for the country. Even if the number of urban households with electricity increases annually, the households in rural areas can't be connected to the network because of the geographic isolation. With this impossibility to be connected on the grid and higher prices for fossil fuels, the interest of the government for renewable energy power systems grows up. However, the investments allocated in these systems remain weak because of the dominant consumption of conventional energy sources in other energy sectors. Considering agriculture is one of the main drivers of the economy in Benin, the provision of electricity in rural areas would greatly increase the quality of life for residents and reduce the migration of the population to the cities.

3. Project:

The interest of this project is to promote the production of electricity in rural areas with renewable energy. For this, the main objective is the installation of photovoltaic systems on three buildings of the Lahotan village. First one will be on the school, the second one on the dispensary and the last one on the main square of the village to give the possibility to the local population to recharge their electrical devices. The choice of these locations provides lighter for the community and increases the quality of life, education and health, for the village. Installation of these systems is a preliminary draft to the formation of a competent staff in the maintenance and installation of sustainable energy systems. Thereafter, the knowledge transmitted to the staff will allow the continuity of installation of photovoltaic systems with future investments. The main idea is to give local people the ability to produce their electrical needs independently. Access to electricity in rural area is one of the most important factors slowing development of village. A second objective is to demonstrate the benefits of PV systems on facilities and the simplicity of installation, maintenance and cost to unlock largest funds with the participation of the government. It becomes necessary to show the benefits of renewable energy at a time when the stability of fossil fuels can't be guaranteed, especially in developing countries to prevent future energy crises.

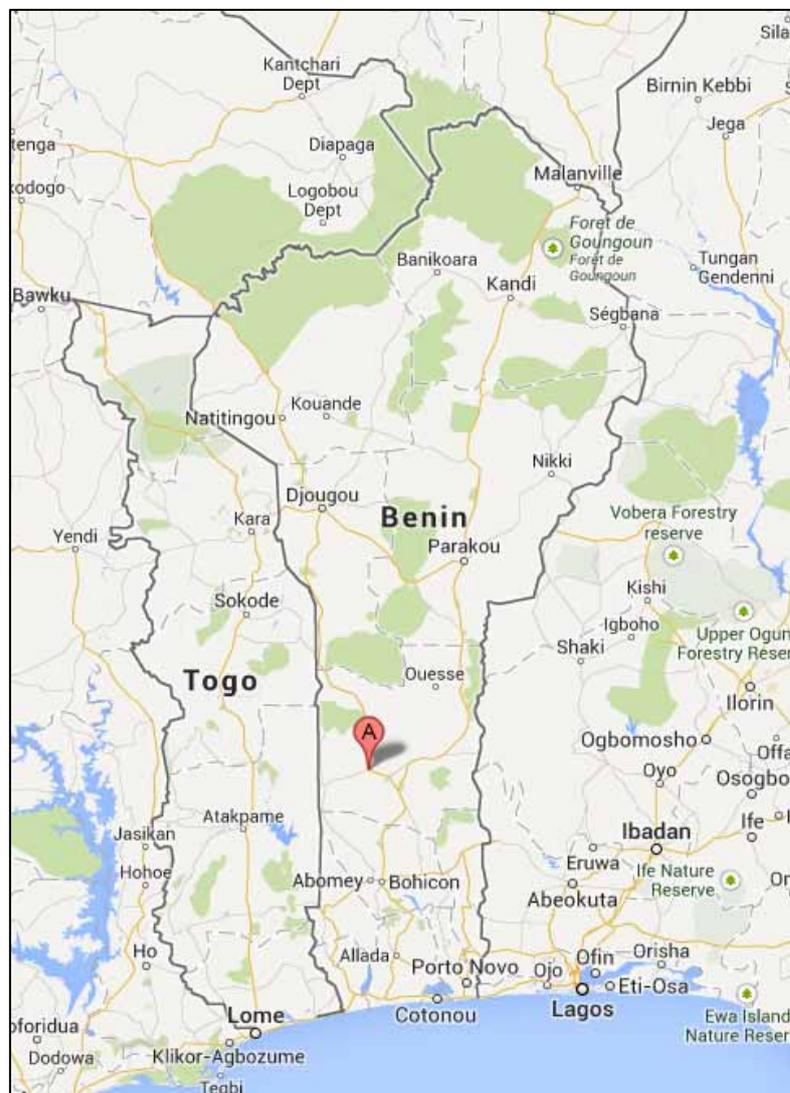
4. Project schedule:

The project has two periods. The first one starts from September to December 2013 and the second phase from January 2014 to March 2014. The deadline of the Master’s thesis report is mid-March 2014. The first phase will be the establishment of a specification, based on funds received and the needs of human resources and logistics of the project. The first part will be supervised by the NGO "Pont-Universel" in collaboration with the local partner Mr. Richard Bruno Attolou, coordinator of the NGO “Action & Solidarity Benin”. The second phase will be the installation and training of personnel on sites by the student Quentin Cavillier. This will include meeting with the NGO "Electriciens sans frontières" and the government to support the promotion of renewable energies in developing countries. A public awareness among the local population will be conducted to ensure the safety of facilities and demonstrate the gains in quality of life with the provision of electricity in rural areas.



5. Facility location:

Global radiation in Benin is on average 210 W/m². This corresponds to 1.5 times the average radiation in Switzerland (140W/m²). With such potential, Benin could easily produce enough electricity for basic needs (lighting, hospitals, schools, agriculture, etc ...) in rural areas. Locations of the three photovoltaic systems are the dispensary, the school and the main square of Lahotan. First constraint of this project is to provide lighting for the two buildings from 7 pm to 11 pm, in other words, 4 hours daily. The systems have to produce electricity for different small electricity devices own needs of the school building or the dispensary. Systems were pre sized according to the needs of a clinic, a school and the population on the square village. The following three descriptions give a first view of the benefits for the local population through the installation of these systems.



Picture 1 : Location of Savalou and Bante

6. Lahotan dispensary

The dispensary of Lahotan includes treatment room, observation room, pharmacy, consultation room, vaccination room, home of the doctor and home of the midwife. A total of fourteen lamps and three electrical outlets must be installed to operate the dispensary day and night. Consequences will be an increase of patients in the dispensary and a reduction for the main hospital of Savalou.



Picture 2 : Lahotan dispensary

The power for the lights and power plug is estimated at 1.05 kWh / day. Two batteries 200Ah-12V, with a capacity of 4.8 kWh, give autonomy of 3 days for a maximum discharge of 70%.

With the annex 1, we need two photovoltaic panels of 200W. The price of the complete equipment with converter and controller is estimated at **3,425 CHF**.

7. Primary school of Lahotan

Installing an electrical system in the school will aim to provide lighting for evening classes and thus reduce the number of students per class and provide opportunities for teachers to prepare their lessons after the end of the day. A secondary objective is to provide a source of electricity to the local population with the purpose to give the possibility to recharge electrical appliances come during the day. The size of facility is for six classrooms and a courtyard with a surplus of electricity production for the loading of various electrical appliances.



Picture 3 : Lahotan school

The consumption for seven lamps during a period of four hours is 0.9 kWh / day. With two batteries for a capacity of 4.8 kWh, we obtain autonomy of 3 days for a maximal discharge of 60%.

Thus we have sizing a system composed of one photovoltaic panel of 280W. The estimated price with all components detailed in annex 2 is **3'055** CHF.

8. Village square

The village square will provide public lighting of 4 hours per day with the provision of power plug for charging electric devices of the population. The system consists of four lamps, two lamps for local recharge and five plugs for a total consumption of 0.48 kWh / day. In our case, a single battery with a capacity of 2.4kWh allows a daily discharge of 20%.

The cost evaluated in annex 3 is **2'755** CHF with the purchase of two photovoltaic modules of 170W. The systems sizing have been based on donations of equipment provided by the company EDF.

9. Financing Plan

Fundraising to install photovoltaic in four villages in Bénin – Project description

One of the major problems of autonomous photovoltaic systems is the way to store electricity. In our case, the use of batteries is required. The budget for the purchase of batteries represents 30% of the purchase price of complete systems. Knowing that their life is 5 years, it is essential to ensure that income generated by these systems will replace these batteries. For this, a contribution of 5 ct will be requested by reloading of electrical devices. Knowing that the average population of the village is 7000, we can assume a minimization of 15 recharges per day per system. For one year, we get 820 CHF incomes per village.

A : Besoins (CHF)	Immédiats	Annuels	Tous les 5 ans
Material (School)	3'425	100	880
Material (Dispensary)	3'055	100	880
Material (Village square)	2'755	100	440
Total	9'235	300	2'200
B : Ressources (CHF)	Immédiates	Annuelles	Restantes après 5 ans
self-financing	-	820	2'600
Donation of materials	3'705	-	-
Sustainability (B-A)	-5'530	+ 520	+ 400

The self-financing of 820CHF per year is underestimated. In the case where benefits will be higher, this amount will be used for construction of other autonomous photovoltaic systems. Two letters are presented in the annex 5 on the promise of the beneficiaries to maintain and secure systems after their installation.

10. Project continuity

After the completion of this project, a test period will be made on the facilities to obtain some results supporting the promotion of photovoltaic power systems. This draft is the first step of a bigger project to install thirty similar systems in other villages. It is therefore essential to show the benefits of photovoltaic cells through one concrete example to support a project on a larger scale. In conclusion, this project hasn't only one objective which is providing power on four rural villages. The long-term goal is to provide a vision to the rural people and government on the importance of these systems for the development of these regions.

Because of the creation of a management committee, we will keep a control on benefits evolution to prevent the case of misuse of earnings. Every month, a control of the account with benefits will give us the possibility to create a sustainable financial plan for long term.

11. Sponsoring and Donations

In the case of donations, sponsoring of a material is possible with the release of the sponsor's logo in all publications related to this project. Donations must be sent on the following account:

Fondation ACUBE
A3 EPFL
CP 122
CH - 1015 Lausanne
Banque : PostFinance
IBAN CH69 0900 0000 1232 1984 7

12. Annex 1 : Lahotan dispensary

Calculation of the numbers of photovoltaic cells:

Converter losses : 10%

Solar energy in Bénta : 550 W/m²

Peak power panel for 1000 W/m² : 200W

*Real power : 0.55 * 200 = 110W*

*Energy requirement : (14 * 20W + 70W) * 3 = 1050 Wh*

Power requirement : 1050/7 = 150 W

*Number of panels : 2 * 110 > 150*

Table of the budget for the system on the dispensary (donation of material in green):

Appliances	Qty	Unit price (CHF)	Total(CHF)
Solar pannel 200 W	2	340	680
Solar controller 12/24 Volts	1	210	210
Converter 220 /12 200 Watts	1	200	200
Batterie 12 volts 200 Ah	2	440	880
Cables VGV souple de 4mm	1	140	140
Cables VGV souple de 2.5mm	1	110	110
Lights 20W	14	15	210
Switchs	4	5	20
Plugs	3	5	15
Grounds plugs	1	60	60
Accessoiries	1	200	200
Labor	1	200	200
Transport	1	500	500
Total			3425

13. Annex 2 : Lahotan school

Calculation of the numbers of photovoltaic cells:

Converter losses : 10%

Solar energy in Bénin : 550 W/m²

Peak power panel for 1000 W/m² : 280W

*Real power : 0.55 * 280 = 154W*

*Energy requirement : (7 * 20W + 70W) * 4 = 840 Wh*

Power requirement : 840/7 = 120 W

*Number of panels : 1 * 154 > 120*

Table of the budget for the system on school (donation of material in green):

Appliances	Qty	Unit price (CHF)	Total(CHF)
Solar pannel 200 W	1	420	420
Solar controller 12/24 Volts	1	210	210
Converter 220 /12 200 Watts	1	200	200
Batterie 12 volts 200 Ah	2	440	880
Cables VGV souple de 4mm	1	140	140
Cables VGV souple de 2.5mm	1	110	110
Lights 20W	7	15	105
Switchs	4	5	20
Plugs	2	5	10
Grounds plugs	1	60	60
Accessoiries	1	200	200
Labor	1	200	200
Transport	1	500	500
Total			3055

14. Annex 3 : the village square of Lahotan

Converter losses : 10%

Solar energy in Bénta : 550 W/m²

Peak power panel for 1000 W/m² = 170W

*Real power : 0.55 * 170 = 93W*

*Energy requirement : (4 * 20W + 2 * 20W) * 4 = 480 Wh*

Power requirement : 480/7 = 69 W

*Number of panels : 2 * 93 > 69*

Assuming system of main square of Lahotan will be mainly dedicated to recharging, we must provide extra power only for charging. In our case, 117W in more offers the possibility to recharge sixty mobile phones (7Wh by phone battery) in 4 hours.

Table of the budget for the village square (donation of material in green):

Appliances	Qty	Unit price (CHF)	Total(CHF)
Solar pannel 200 W	2	280	560
Solar controller 12/24 Volts	1	210	210
Converter 220 /12 200 Watts	1	200	200
Batterie 12 volts 200 Ah	1	440	440
Cables VGV souple de 4mm	1	140	140
Cables VGV souple de 2.5mm	1	110	110
Lights 20W	6	15	90
Switchs	4	5	20
Plugs	5	5	25
Grounds plugs	1	60	60
Accessories	1	200	200
Labor	1	200	200
Transport	1	500	500
Total			2755

15. Annex 4: Letters of commitment from beneficiaries

Savalou, le 07 janvier 2013

FAEG/
REPUBLIQUE DU BENIN

DEPARTEMENT DES COLLINES

COMMUNE DE SAVALOU

N°4KJ 017 /M/SG-SA.-

Le Maire de la Commune de Savalou

A

Monsieur le Coordonnateur National de
l'ONG « Actions Bénin et Solidarité » (ABS)

OBJET : engagement pour la pérennisation du système
photovoltaïque à installer dans la Commune de Savalou

Monsieur le Coordonnateur,

Par la présente, la Mairie de Savalou vient marquer son adhésion et son soutien au projet d'installation du système électrique à partir des panneaux solaires dans les structures sanitaires et éducatives que sont les écoles, l'hôpital de zone de Savalou, les centres de santé de Lahotan et Gobada. Au nom du Conseil Communal de Savalou, je voudrais présenter mes vifs et sincères remerciements à votre ONG ainsi qu'à votre partenaire « Electriciens Sans Frontière de France » pour le choix porté sur la Commune de Savalou.

Par cette même occasion, la Mairie de Savalou s'engage à assurer la maintenance préventive et curative des installations qui seront mises en place en vue de la pérennisation du système photovoltaïque.

Convaincu de ce fructueux partenariat, je vous prie de recevoir, Monsieur le Coordonnateur, l'expression de mes salutations distinguées.

Ampliations :

- Médecin Coordonnateur Zone Sanitaire.....01
- DDS Z/C 01

Le Maire par Intérim,

Cossi T. AGBALLA.-



Commune de Savalou BP: 90 Tél: 22 54 02 17 / 22 54 06 84 comsavalou@yahoo.fr

HJ / SSA
REPUBLIQUE DU BENIN

MINISTERE DES ENSEIGNEMENTS MATERNEL ET
PRIMAIRE

DIRECTION DEPARTEMENTALE DES
ENSEIGNEMENTS MATERNEL ET
PRIMAIRE DU ZOU ET DES COLLINES

CIRCONSCRIPTION SCOLAIRE DE SAVALOU

SO N° 014 D-EPP/LHT-A / CS / SVL

Savalou, 14 Janvier 2013

Le Directeur de l'Ecole Primaire
Publique de LAHOTAN / A.
A
Monsieur le Coordonnateur National de
L'ONG "Actions – Bénin et Solidarité"

Objet : Lettre d'engagement.

Monsieur le Coordonnateur,

Je soussigné, Mr **DONUGBO Bloukou**, Directeur de l'école Primaire Publique de LAHOTAN/A, m'engage pour la pérennisation du système photovoltaïque à installer dans mon école.

Je vous rassure d'ores et déjà de ma disponibilité à œuvrer pour la sécurisation et le bon usage dudit système.

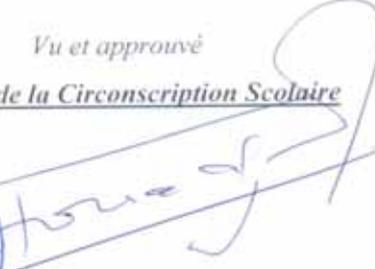
Le Directeur de LAHOTAN-A



Bloukou C. DONUGBO

Vu et approuvé

Le Chef de la Circonscription Scolaire



Justin HOUADJETO