ZONGO IVAN

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Abstract

This paper describes a development project which will be undertaken in Burkina Faso, a west African country with low access to electricity (Table 1). In this paper, we try to describe how a solar system project will be implemented to increase access to electricity. Actually, it is important to mention that despite the harsh climate, Burkina Faso's agriculture sector continues to generate roughly a third of the country's GDP and employs 80 percent of the population[1]. Providing access to electricity to these rural populations will significantly improve agricultural production by using new production techniques, which most of the time require electricity. The arrival of electricity in these agricultural zones will also promote the transformation of agricultural products, which allows for the preservation of perishables products once they are produced and increase activities and employment around these zones where the project will be implemented.

[1] "Agriculture and Food Security: Burkina Faso." U.S. Agency for International Development, 14 Apr. 2017, https://www.usaid.gov/burkina-faso/agriculture-and-food-security.

INTRODUCTION

The electricity production of Burkina Faso mainly relies on thermal-fossil fuel (about 70% of the total power generation capacity in the country) and hydropower [1]. The electricity production is based on 28 fossil fuel power stations and 4 hydropower stations. According to the latest SE4All Global Tracking Framework (2015), the access to electricity annual growth rate in Burkina Faso from 2010 to 2012 is 0%. The rural electrification strategy for Burkina Faso is scattered in several electricity sector development policies: there is a need to define a concrete action plan. The use of spatial analysis as a decision support tool could support the definition of general rules for a more functional rural electrification plan at the national level in Africa, as other studies have demonstrated.[2]

A lot of studies showed the importance of electricity for the endogenous development of countries. Having stable electricity is important for several reasons, all of which relate to the Millenium Development Goals. First of all, access to electricity helps to eradicate extreme poverty and hunger (Goal 1): Access to electricity facilitates economic development by, for example, fostering the growth of micro-enterprise, enabling livelihood activities to continue beyond daylight hours, improving the efficiency of locally owned businesses (thereby generating increased employment), enabling the development of more efficient and healthier means of undertaking productive activities, and helping to bridge the 'digital divide. Halving the proportion of the population living on less than one dollar a day is unlikely to occur unless electricity is provided to those who now lack access to it (IEA,2004, 2006).[3]

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[2] Moner-Girona, M, et al. "Universal Access to Electricity in Burkina Faso: Scaling-up Renewable Energy Technologies." Environmental Research Letters, vol. 11, no. 8, 2016, p. 084010., https://doi.org/10.1088/1748-9326/11/8/084010

[3] Energy for the Poor: Underpinning the Millennium Development Goals, https://www.iatp.org/sites/default/files/Energy_for_the_Poor_Underpinning_the_Millenniu.htm.

In addition, access to electricity helps to achieve universal primary education (Goal 2): Access to electricity reduces the time spent by children on basic survival activities, such as gathering fuel wood, fetching water, and cooking. Lighting permits home study, increases security, and enables the use of educational media and communications in schools, including information and communication technologies (ICT). In the UNDP/WHO study, it was found that education enrolment ratios correlate with access to electricity.

Access to electricity also helps promote gender equality and the empowerment of women (Goal 3): Access to electricity reduces the physical burden and time spent by women and children, especially girls, in gathering and carrying fuel, wood, and fetching water. Electrification provides women with more efficient and healthier means of undertaking basic household tasks and promotes increased opportunities for employment, such as running small household businesses. In addition, better street lighting improves safety for women at night.

Furthermore, access to electricity helps reduce child mortality, improve maternal health, and combat HIV/AIDS, malaria, and other diseases (Goal 4, Goal 5, and Goal 6): Electricity is a key component of a functioning health system, enabling, for example, increased lighting, the refrigeration of vaccines and other medicines, and the use of electrical medical equipment. In the UNDP-WHO study, it was found that childhood mortality is correlated with access to electricity. When the share of the population with access to electricity exceeds 60%, the mortality rate for children under five is relatively low.

Finally, access to electricity helps to ensure environmental sustainability (Goal 7): Electricity can be used to power water pumps that provide drinking water, thereby facilitating the achievement of Target 7.C, of halving, by 2015, the proportion of the population without sustainable access to safe drinking water. The use of renewable energy to provide electricity to the poor can help to achieve sustainable

use of natural resources, as well as reduce greenhouse gas emissions, thereby protecting the local and global environment.[4]

Even though the Millenium Development Goals is a project which is over or past, the targets and objectives of this project are still topical subjects and are in line with some of the objectives of our project. In fact, the Millenium Development Goals had some quantified and defined objectives, and our project aim is to bring more to what was already done.

Selected province or department based on solar irradiation

While all developing countries will benefit from having stable electricity, I believe Burkina Faso, in particular, demonstrates a great opportunity. The first reason is that there is a great deal of solar irradiation, particularly in the Northern and Eastern zones. Actually, a special check allows us to see that the Northern and Eastern part of the country is the zone which is the most exposed to solar irradiation, with some irradiations close to 2370 kWh/m^2 (Figure 1). The zone that has been chosen, therefore, will be the Est region, with a population of 1,941,505 inhabitants.

This region is specialized in the production of cereal crops like millet and sorghum, and chickpeas.[5]

[4] Shyu, Chian-Woei. "Ensuring Access to Electricity and Minimum Basic Electricity Needs as a Goal for the Post-MDG Development Agenda after 2015." Energy for Sustainable Development, vol. 19, 2014, pp. 29–38., https://doi.org/10.1016/j.esd.2013.11.005.

[5]" BULLETIN CONJOINT D'INFORMATION SUR LES MARCHES AU BURKINA FASO" WFP 2021 ., https://reliefweb.int/sites/reliefweb.int/files/resources/Bulletin%20conjoint%20d%27information%20sur%20les%20marche%CC%81s%20PAM%20-SONAGESS_%20Avril%202021.pdf

Second, the country counts approximately 95% of women who work in subsistence agriculture or the informal sector, using low levels of technology. According to the Ministry of the Environment and Tourism, women play an important role in the utilization and management of forest resources.

Women divide their time between agricultural and domestic tasks, spending as much as 16 hours a day in such work, including food processing and preparation. Their limited access to water and fuel increases their work burden (Division of Labor by Gender). Social and economic decisions in the family and the community are usually made by men and the elderly. Although public life is dominated by men, since the 1980s, a growing number of women's groups have been promoting the interests of women. (Gender Relations in Decision-making in Farming Activities).[6]

Actually, it is known that investing in women has a multiplier effect, as a higher proportion of women's income is reinvested in the family and community as compared to men's incomes.[7]

Therefore, we will choose to locate this project in the province of Bogande. This is because the province of Bogande, which is a subdivision of the region, has a high population density and because of the high percentage of women in that region compared to men, with 51.29% of women and 48.71% of men.

Through the implementation of a solar energy system in that region, women will be able to undertake some lucrative activities associated with agriculture and farming, such as the transformation of raw agricultural products and drinking through for their animals with solar water pumps. The access to electricity will also increase the access to school and especially for girls who have a low rate of

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[6] "Women's Legal Rights." Fact Sheet: Burkina Faso - Women, Agriculture and Rural Development, http://www.fao.org/3/V7947e/v7947e04.htm.

[7] Almeida, Rachel. "Promoting the Inclusion of Women in Burkina Faso." Medium, Medium, 10 Mar. 2017, https://medium.com/@_almeidarachel/https-medium-com-almeidarachel-promoting-the-inclusion-of-women-in-burkina-faso-f21b05f06ad7

schooling in the country (Figure 2). This will also increase the happiness of the population living in these areas and increase their income(Figure 3, Figure 4, Figure 5). This province is also one of the wholesale market centers, which makes it a very important province for production and, as a result, will provide more employment for women and the youth in general. (Figure 6).

The rest of this paper details the plan I will follow.

Feasibility studies

Before work begins, I will conduct feasibility studies. I plan to travel to Burkina Faso during the summer of 2021 to set these up.

For the feasibility studies, some technicians and experts in solar energy will be hired to study the zone and provide some suggestions about the required materials, the installation sizing and setting, the maintenance of the equipment, the power balance, the consumption reading, and the life span of the material so that they can be renewed at the right time.

Sociologic and anthropological studies need to be undertaken to measure the real impact of such a project on the life of the concerned inhabitants. For instance, these studies and the results of these studies will help to have an idea of the type of activities that occur in this zone or area and how people will perceive such a project. All these studies will help to facilitate the interactions between the inhabitants and the authorities.

Approval of the inhabitants

For this purpose, some intermediates who are close to the inhabitants and the leaders of this zone will be hired. To find these people, we will look for persons who are native to these zones and who speak both the local language of that zone and the official language of the country (French). English can also be an asset as some silent partners will need some reports of the activities. In addition, a degree in communication and/or marketing will be required to be certain that the intermediates will be able to give good information in the right way[8]. To sum up, these intermediates will have more incentive to participate as they will be paid, and they will want to help their community. These intermediates will initiate the conversation with the leaders and show them the validity and the legitimacy of the project. This step is one of the most important as it will determine the success or failure of the project. In conjunction with these intermediates, some advertisement structures will be hired for awareness campaigns about the project's purposes to create more incentives for the population to adhere to the project. For instance, a lot of projects are doomed to failure as they do not have the support of the inhabitants. These inhabitants have the feeling that the project is not for their well-being, and their lands are used and exploited to satisfy some individuals or groups of people.

[8] "The difference between the almost right word and the right word is really a large matter. 'tis the difference between the lightning bug and the lightning" Mark Twain

Evaluation of the costs

Costs plan[9]

Components	Cost of the project		
	Unit cost (In dollar)	Number	Total cost (In dollar)
My round trip total cost (using Turkish Airlines at the economic class) plus a five star hotel (Laico Ouaga 2000) using Kayak[10] as my service provider[11]	7,409	1	7409
Advertising structures for awareness campaigns(UBICOM[12] with 10 people's team. We will use 3 teams)	1,131.35	6	6788.1
Intermediates/translators[13]	258.70	10	2587
Cost of solar panels/unit (inspired by the zagtouli project)[14]	233	1000	233000
Local experts in solar system[15]	5656.57	10	56565.7
Installation price except technicians wage[16]	206.93	1000	206930
wage of the installation technicians maintenance included[17]	323.34	120	38800.8
Cost of the area[18]	65662.5	0.36	23638.5
Compensations for relocating inhabitants of the area if any[19]			34,489.28
Management of the project[20]	4243	10	42430
unforeseen events (10% of the expenses before total budget)[21]			65302
Private survey structures (minimum of 20 persons)[22]	7.63	50	381.5
Total			**718,322**

[9] Note: Completed in 2017, the Zagtouli solar power plant includes the installation of nearly 130,000 panels on 60 ha of land. Today, the plant has an effective power of 33.7 MWp, ie a production of around 55 GWh / year, representing 4% of Burkinabè's annual electricity consumption. It is the equivalent of the consumption of 660,000 people and its economic cost of production is estimated between 30 and 40 FCFA / kWh. A cost significantly lower than the average production cost of SONABEL, which stood at 133 FCFA per kWh in 2016. From an environmental and social point of view, the Zagtouli solar power plant currently saves 26,000 tonnes of CO2. It contributes to accelerating the development of skills in the field of solar energy in Burkina Faso.

[10] "SFO to Burkina Faso, Dec 20 - Jan 15." KAYAK, https://www.kayak.com/packages/Burkina-Faso-U38/2021-12-20/2022-01-15/-1,-1/1/0,0,0/SFO?sort=rank_a&fs=stars.

[11] This trip total cost is the price mentioned on the Kayak website at the moment the project was elaborated.

[12]"Agence UBICOM, Ouagadougou." Sortlist, https://www.sortlist.com/fr/agency/agence-ubicom.

[13] Accueil. Petites annonces Ouagadougou, Burkina Faso, BF. (n.d.). Retrieved December 5, 2021, from https://bf.afribaba.com/ouagadougou/interpreting-amp-translating-traduction-interpretariat-amp-services-de-tou-27638.html.

[14] "Panneau Photovoltaïque Monocristallin Victron 215 WC." Panneaux Solaires Et Matériel Pour Site Isolé Depuis 2007, https://www.ecolodis-solaire.com/panneau-photovoltaique-monocristallin-34/panneau-photovoltaique-monocristallin-victron-215-wc-3298.

[15] Ingnieur en Nergie Solaire. Energie recrute, votre r. (n.d.). Retrieved December 5, 2021, from https://www.energierecrute.com/formation_energie/metier-ingenieur-en-energie-solaire~118.html.

[16] Burkina Faso Rapport De L Production D Eau ... - AEE INTEC. https://www.aee-intec.at/0uploads/dateien1211.pdf.

[17] Etude sur le lien entre la qualification et la qualite des ... (n.d.). Retrieved December 4, 2021, from https://snv.org/assets/explore/download/evidence_sur_le_lien_entre_la_qualite_et_la_qualification.pdf.

[18] "Terrains & Parcelles à Vendre à Bogandé: Jumia Burkina Faso." Jumia Burkina Faso | Petites Annonces Gratuites | Achat Et Vente, https://www.jumia.bf/bogande/terrains-parcelles.

[19] World Bank Document. https://documents.worldbank.org/curated/en/212271468232770636/pdf/SFG1987-RP-FRENCH-P151832-Box394880B-PUBLIC-Disclosed-3-24-2016.pdf.

[20] Burkina Faso - projet d'électrification des zones péri-urbaines de Ouagadougou et de Bobo-Dioulasso. (n.d.). Retrieved December 4, 2021,P.4 from https://projectsportal.afdb.org/dataportal/VProject/show/P-BF-FA0-007?lang=fr.

[21] Group, A. D. B. (2019, September 19). Burkina-faso - plan solaire Burkina Faso: Projet Yeleen - Cadrage et étude de faisabilité de centrales solaires PV - résumé par. Banque africaine de développement - Bâtir aujourd'hui, une meilleure Afrique demain. Retrieved December 4, 2021, from https://www.afdb.org/fr/documents/burkina-faso-plan-solaire-burkina-faso-projet-yeleen-cadrage-et-etude-de-faisabilite-de-centrales-solaires-pv-resume-par.

[22] Annex 5: Evaluation report standard format - un.org. (n.d.). Retrieved December 4, 2021, from https://www.un.org/democracyfund/sites/www.un.org.democracyfund/files/burkina_faso_-_udf-10-350-bkf_-_evaluation_report.pdf.

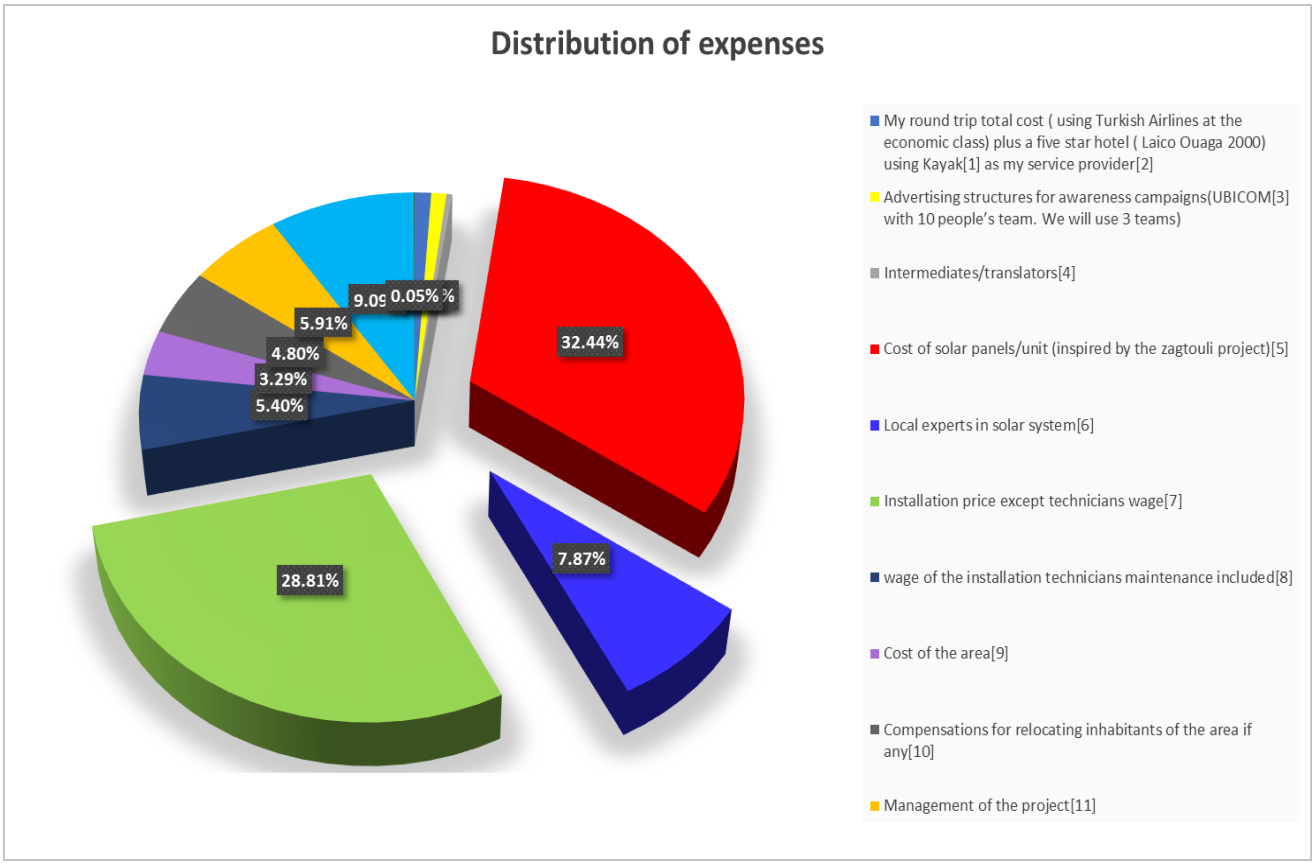
I got the price of each solar panel by deriving it from the project Zagtouli which was dealing with monocrystalline photovoltaic panels with around 250 Wc of capacity.

I also got the cost of the area by checking at first how much space each solar panel needs to be based on the Zagtouli project, and thus I found the final price by multiplying the number of solar panels by the price per hectare.

The potential main backers for our project will be searched in the list of the ten (10) main silent partners or backers of Burkina Faso in 2018 (Figure 7). As far as possible, we will be willing to have the World Bank as our backer as this organization is involved in a lot of renewable energy projects in the world and especially in Africa.[23]

We could not find information on the cost of installation in this specific region of Burkina Faso; then, to arrive at this summary of the costs, we used some sources related to projects in Burkina Faso which are close to the one we are working on. These projects are at first the project Yeleen with the installation of 130.000 solar panels in Zagtouli, a county of Burkina Faso. Secondly, we used a Non-governmental Organization's working paper about a study on the qualification and the quality of renewable energy services in Burkina Faso.

[23] World Bank Group. "World Bank Adds Funding to the Regional off-Grid Electricity Access Project to Promote Solar Products in Western and Central Africa." World Bank, World Bank Group, 11 Mar. 2021, https://www.worldbank.org/en/news/press-release/2021/03/11/world-bank-adds-funding-to-the-regional-off-grid-electricity-access-project-to-promote-solar-products-in-western-and-cen.


Distribution of expenses
9.09%
0.05%
5.91%
4.80%
3.29%
5.40%
32.44%
7.87%
28.81%
My round trip total cost (using Turkish Airlines at the economic class) plus a five star hotel (Laico Ouaga 2000) using Kayak[1] as my service provider[2]
Advertising structures for awareness campaigns(UBICOM[3] with 10 people's team. We will use 3 teams)
Intermediates/translators[4]
Cost of solar panels/unit (inspired by the zagtouli project)[5]
Local experts in solar system[6]
Installation price except technicians wage[7]
wage of the installation technicians maintenance included[8]
Cost of the area[9]
Compensations for relocating inhabitants of the area if any[10]
Management of the project[11]

Analysis of a sample of providers in urban and rural areas as well as their qualification level

To reach our objectives, we worked on a sample of two-component service providers in the solar energy industry.

1. First component

The company that will be in charge of the materials and equipment will be OMEXOM. It is the company from which we will buy our solar equipment and materials, and it is also the company that will coordinate the work of the technicians we will define below.

Actually, Omexom's solution, a company settled in France, targets those who produce, transform and transport electricity, including local authorities. Omexom thus helps energy producers, grid operators, and territories fulfill their missions whilst simultaneously navigating the evolving landscape. Omexom's expertise in the field of electrical grids allows us to anticipate the impact of renewable energies. Omexom then works to develop storage solutions, make more sustainable infrastructures, and meet new consumption trends.[24]

2. Second component[25]

This category which is mainly composed of technicians, will be subdivided into two groups:

[24] "About Us." Omexom, 6 Apr. 2021, https://www.omexom.com/about-us/

[25] Etude Sur Le Lien Entre La Qualification Et La Qualite Des ... https://snv.org/cms/sites/default/files/explore/download/evidence_sur_le_lien_entre_la_qualite_et_la_qualification.pdf.

- The group of the untrained service providers
- And the group of trained service providers

a) The group of the untrained service providers

This group consists of Renewable Energy system providers who have not received qualifying training in the field, but the majority of them hold diplomas from general secondary education (CEPE, BEPC, BAC) and who have practiced in a professional structure before setting up their own. All these form the category of untrained providers.

b) And the group of trained service providers

This group is made up of :

- Young people who have received degree training at the level of structures and institutes secondary and tertiary training and currently working in the renewable energy domain. Those are trained, graduate providers.
- People already active in their region (young small storekeepers, employees, members associations, or groups) have received basic training from structures in renewable energy with certificates issued at the end. They are certified trained providers.
- Young people who have dropped out of school and holders of the CEPE or the BEPC have been trained in national training centers and holders of Professional Qualification Certificates. They are also certified trained providers.

The providers active in the renewable energy sector which constitute these two components are specifically equipment suppliers, installers, and suppliers-installers. They operate in urban and rural areas.

The national structures of technical secondary education such as the ANPE[26], FAFPA[27], Jan Vervoot Centre for Technical Education and Vocational Training Boulsa in the province of Namentenga (under public jurisdiction,15), the Regional Center for Vocational Training of Manga in Zoundwéogo, and finally the Don Bosco Private Vocational Training Centre in Bobo-Dioulasso in the Houet which trained these people are therefore our references to hire the technicians.

For the maintenance, the same company OMEXOM will be in charge of the maintenance for five years (This will be stated in the contract in reference to the project Yeleen in Zagtouli between this company and the government[28]). Then, After the fifth year, another company named YANDALUX will be hired for this purpose with a longer contract.

Founded in 2004, YANDALUX is a Hamburg-based company that relies on its large network of partners established in West Africa to offer all kinds of autonomous solar application solutions. To name just one number as a guarantee of efficiency, to date, they have supplied more than 20 megawatts worldwide.[29]

[26] National Employment Agency
[27] Support Fund for Vocational and Apprenticeship Training
[28] Focus on Zagtouli Solar Farm Project. Omexom FR. (2020, September 17). Retrieved November 12, 2021, from https://www.omexom.fr/use-case/focus-on-zagtouli-solar-farm-project/.

[29] Yandalux. (n.d.). Bienvenue chez yandalux. YANDALUX. Retrieved November 12, 2021, from http://www.yandalux.com/index_fr.html.

Monitoring and management of the project

Solar panels can last 25 years if well maintained. For instance, solar energy materials are very fragile, and their maintenance can be challenging and expensive, above all, when the country is a poor country. Then, all the activities related to monitoring and management should be taken seriously to improve the lifespan of these installations and get the best results.

I hope to evaluate this project every five years through some annual reports as the support project for Local Development in the Provinces of Comoé, Léraba, and Kénédougou in Burkina Faso did[30]. I also plan to borrow its process in defining, assessing, and prioritizing the objectives and describe the methods that will be used to monitor them. Finally, a survey company will be hired for this purpose to do some surveys every 5 years so that we can assess the progression of the project.

Targeted population

In my project, I did not try to target the concerned population individually. It is also important to note that these areas already have access to electricity. Actually, the objective of the project is to reduce as much as possible the cost of electricity for the population of Bogande, especially the areas where we have a high rate of activities involving women. Then, we will be less concerned with the demand in the sense that the objective will be to reduce to the maximum the cost of electricity for these populations.

[30] Burkina Faso - Projet D'appui Au Développement Local Des Provinces De La Comoé, De Léraba Et Du Kénédougou, https://projectsportal.afdb.org/dataportal/VProject/show/P-BF-AA0-021?lang=fr.

The population of Bogande will be the first who will benefit from this project. It is also important to mention that the project is not individually centered, and the objective is to encourage collective entrepreneurship and develop collective practices among the population of Bogande. For our project, any area in Bogande with great potential in women's entrepreneurship will be considered a priority for electricity access. To be specific, the inhabitants of villages without access to electricity will be the first ones to benefit from the connection to this solar energy power station. The priority of the project will be to serve zones without access to electricity and with a high rate of activities involving women. Inhabitants of areas that have a lot of women associations and companies will be considered as zones "with the high rate of activities involving women." For instance, the inhabitants and especially the women of these areas, will get access to electricity at a lower cost. This will induce the creation of new activities and increase entrepreneurship in that region based on this new source of energy. It is also important to recall that the main purpose of this project is to invest in women, especially in activities in which women are involved. Actually, the inhabitants of zones with a great proportion of women involved in the agriculture sector will also be considered. For example, the project may help these women to dry their agricultural products for conservation purposes with their electric driers at a lower cost. This project may also help women to have some small production units of shea butter and peanut butter, which require machinery and a great quantity of electricity. In addition, as women are very involved in selling activities of fresh products (fish, vegetables, food), this project will help them to run their refrigerators without the fear of paying high bills too. Women in rural areas, as an activity, are used to partially transform the raw agricultural products with mills for some payment. The project, in that sense, will reduce their marginal cost and increase their revenue as they will pay less for the electricity. This will also allow them to increase the size of their business. This project, in parallel, will help the children to have access to this electricity for their

studies. Finally, this project will target the zones with a high number of maternities and hospitals. In fact, maternities will be able to acquire more vaccines and serums' refrigerators as they will be able to save a big part of their budget, which was dedicated to paying the electricity bills. Thus, these maternities will be able to invest in other more vital equipment.

Final checking

HIERARCHY OF OBJECTIVES	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION (MDV) ASSUMPTIONS / RISKS	HYPOTHESIS / RISKS	PROJECTION OF ACTIVITIES THAT MAY BE CREATED OR IMPROVED
1. Sectorial objective 1.1 The poverty reduction of the concerned population and especially women.	**1.1 Check the total income per household after the implementation of the project.** **1.2 Check the contribution of women to the total income of households**	**1.1 Reports on national statistics and household surveys**	**1.1 Demographic pressure contained and regular solar irradiation.** **2.2 Solar panels works normally and maintenance is done regularly** **2.3 The rural community is prepared enough for this shift to the solar energy through awareness compaigns by the intermadiates that have been hired in collaboration with advertisement structures.**	**• Solar bread oven for baking activities.** **• Solar powered hairdressing salon for women and men.** **• Sewing workshop running on solar energy.** **• Creation of a professional training pole in the province like mechanics for automobiles,carpating...** **• Alleviate the intensification of deforestation in that zone.**
2.Objectives of the project 2.1 The inclusion of women in the economical activities of the province and the country in general. 2.2 The increase of employment generating activities. 2.3 The increase of schooling and professional training for girls and children in general. 2.4 Promotion of transformation and consumption of local products 2.5 Diversification of activities in this province 2.6 Limition of deforestation through the use of solar electricity as the first source of energy for all needs.	**2.1 Check the percentage of people who have access to electricity in that province through surveys.** **2.2 Check the number of women and girls involved in economical activities per households through surveys.** **2.3 Check the number of new activities created by the project.** **2.4 Check the impact of this project on the electricity price in that specific province.** **2.5 Check the school rate in that province after the implementation of that project**	**2.1 Activities and supervision reports.** **2.2 Contracts,reassessment if needed.** **2.3 List of goods and services used during the project the project.** **2.4 Report on annual statistics and household survey.** **2.5 Half-yearly, annual and end-of-year project reports and national statistics reports.**	**2.1 Women and the youth are strenghthen and professionalized through some associations and groups that they created beforehand to get access to these training sessions.** **2.2 Risk of bandwidth issue in the sence that a drop in electricity price maynot change necessarily people habits in that province.**	**• Horticulture project** **• Village poultry farming** **• Transformation of shea, peanut and other seeds with solar mills to create derivative products of these seeds.** **• Use of solar pumps to get access to drinking water and to water animals.** **• Increase in agriculture production through irrigation systems.**

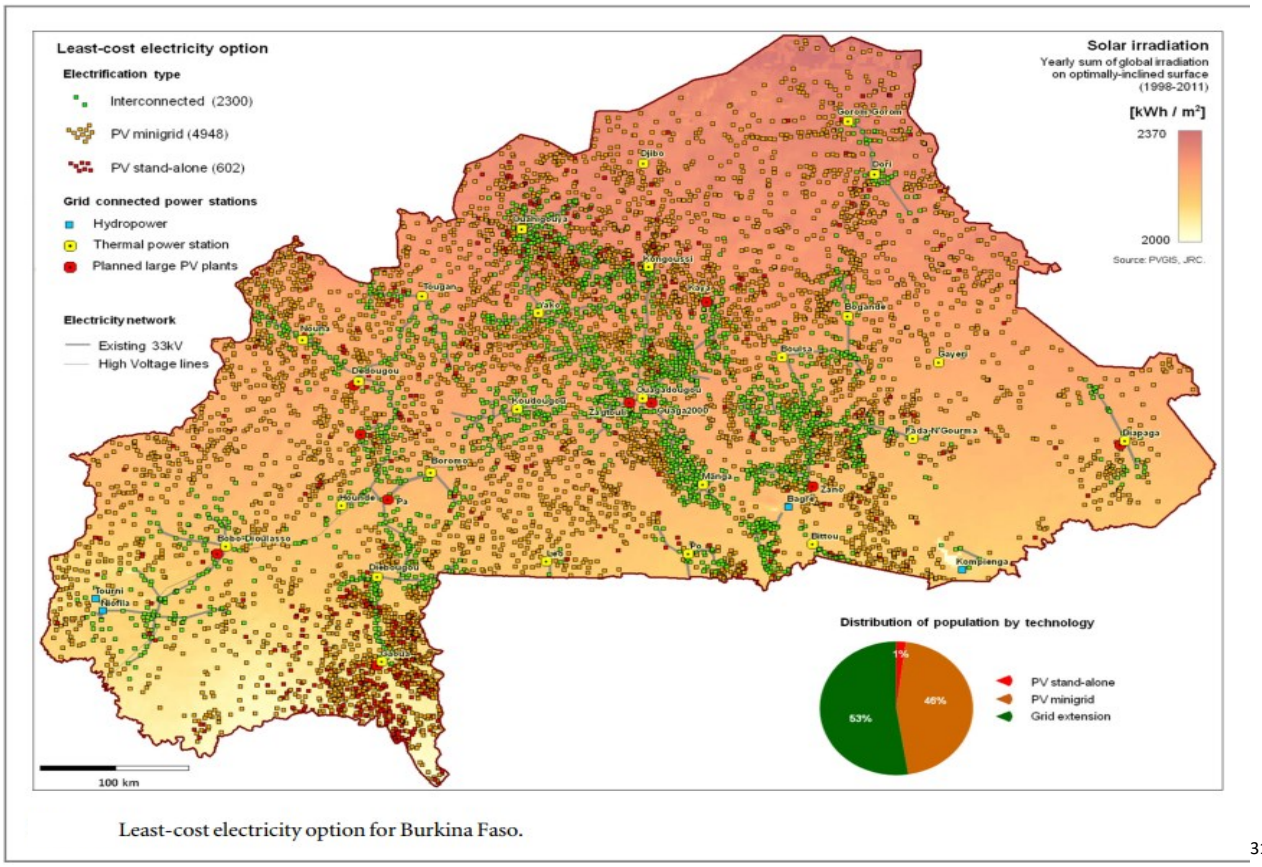
CONCLUSION

The objective of this document is to give as much as details on how the project can be implemented in the province of Bogande. Solar energy is one of the energies of the future. Investing in that energy as our project's intent is to build a path to sustainable development. It is important to note that the beneficial effects of these types of projects are pretty vast and more often observable in the long term, hence the necessity to be sure that the steps in the process are respected to the letter. Then, we will be sure that the projected and expected effects are accurate.

Finally, we hope with this project to create an additional growth pole to the existing one in Burkina Faso, as growth poles are the catalyst for development in developing countries.

APPENDIX

Figure 1

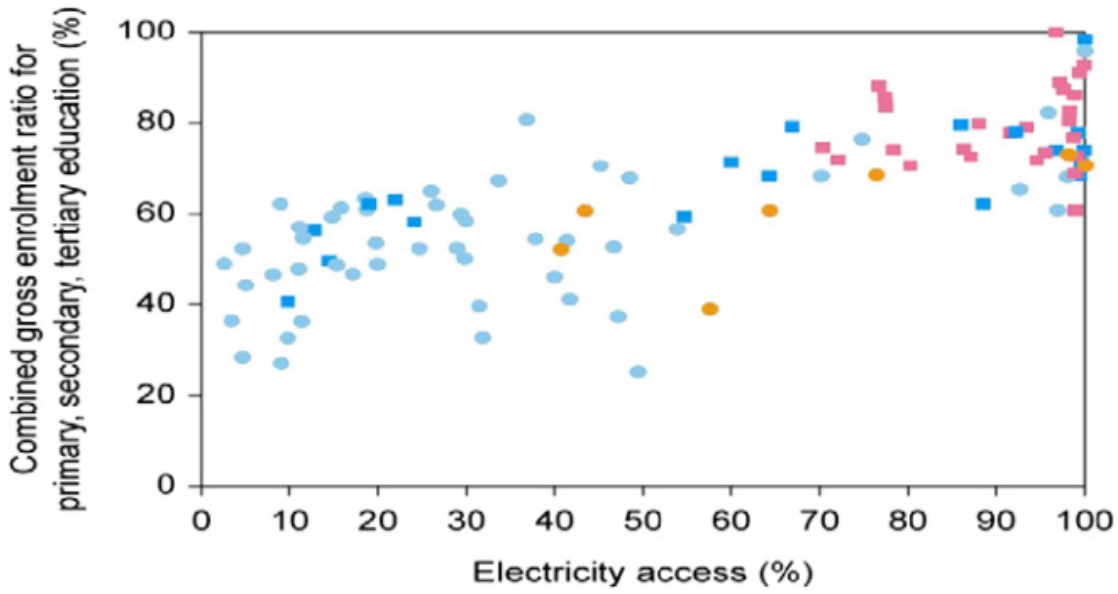


Least-cost electricity option for Burkina Faso.

[31]

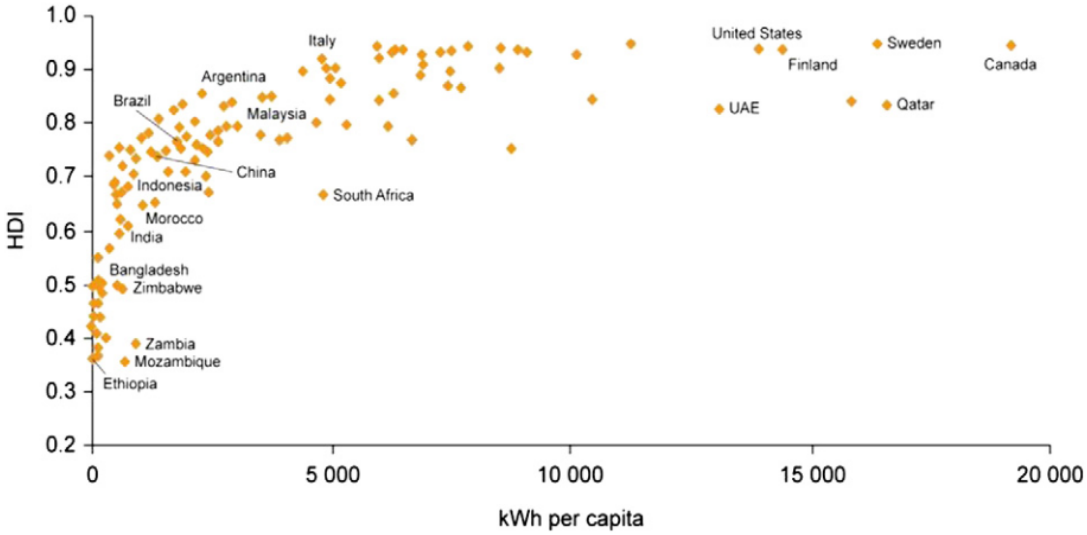
[31] Moner-Girona, M, et al. "Universal Access to Electricity in Burkina Faso: Scaling-up Renewable Energy Technologies." Environmental Research Letters, vol. 11, no. 8, 2016, p. 084010., https://doi.org/10.1088/1748-9326/11/8/084010.

Figure 2



Source: Data from Legros et al., 2009. Drawn by author.

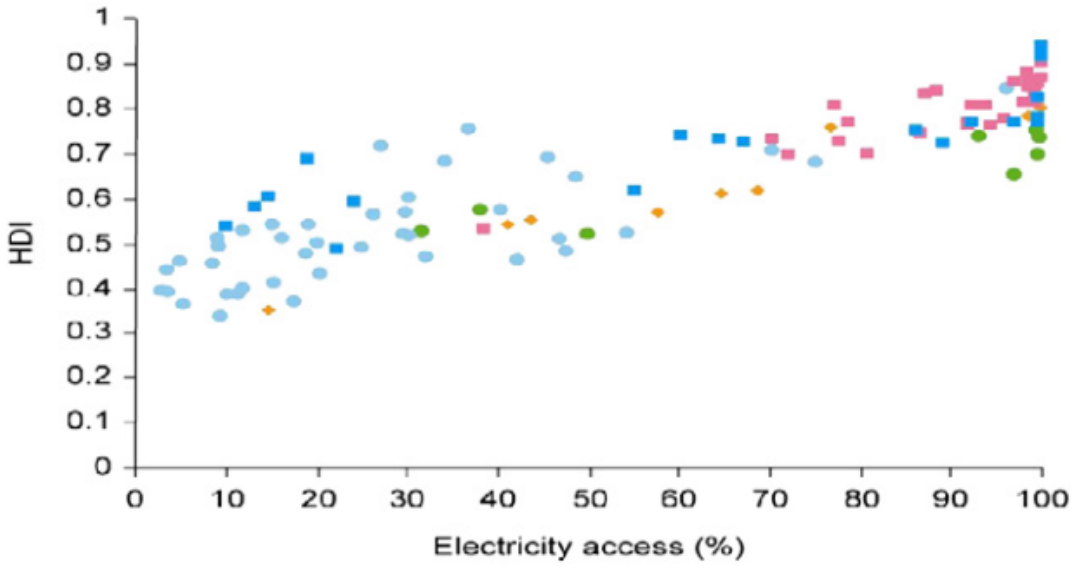
Figure 3



Source: Data from IEA, 2004. Drawn by author.

Fig. 5. Per capita electricity consumption per year and HDI in 2002.
Source: Data from IEA (2004). Redrawn by author.

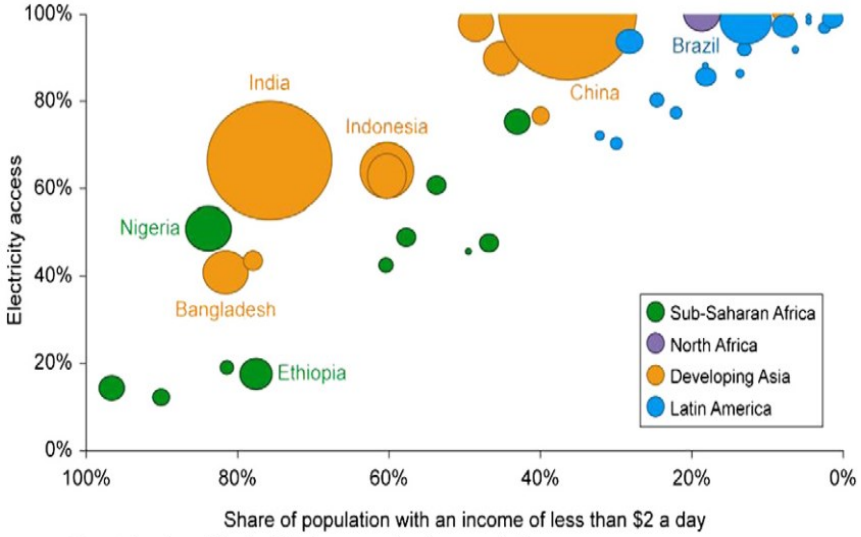
Figure 4



Source: Data from Legros et al., 2009. Drawn by author.

Electricity access and HDI.
Source: Data from Legros et al. (2009). Redrawn by author.

Figure 5



Note: The size of the bubble is proportional to population.
Source: Data from IEA, 2010. Drawn by author.

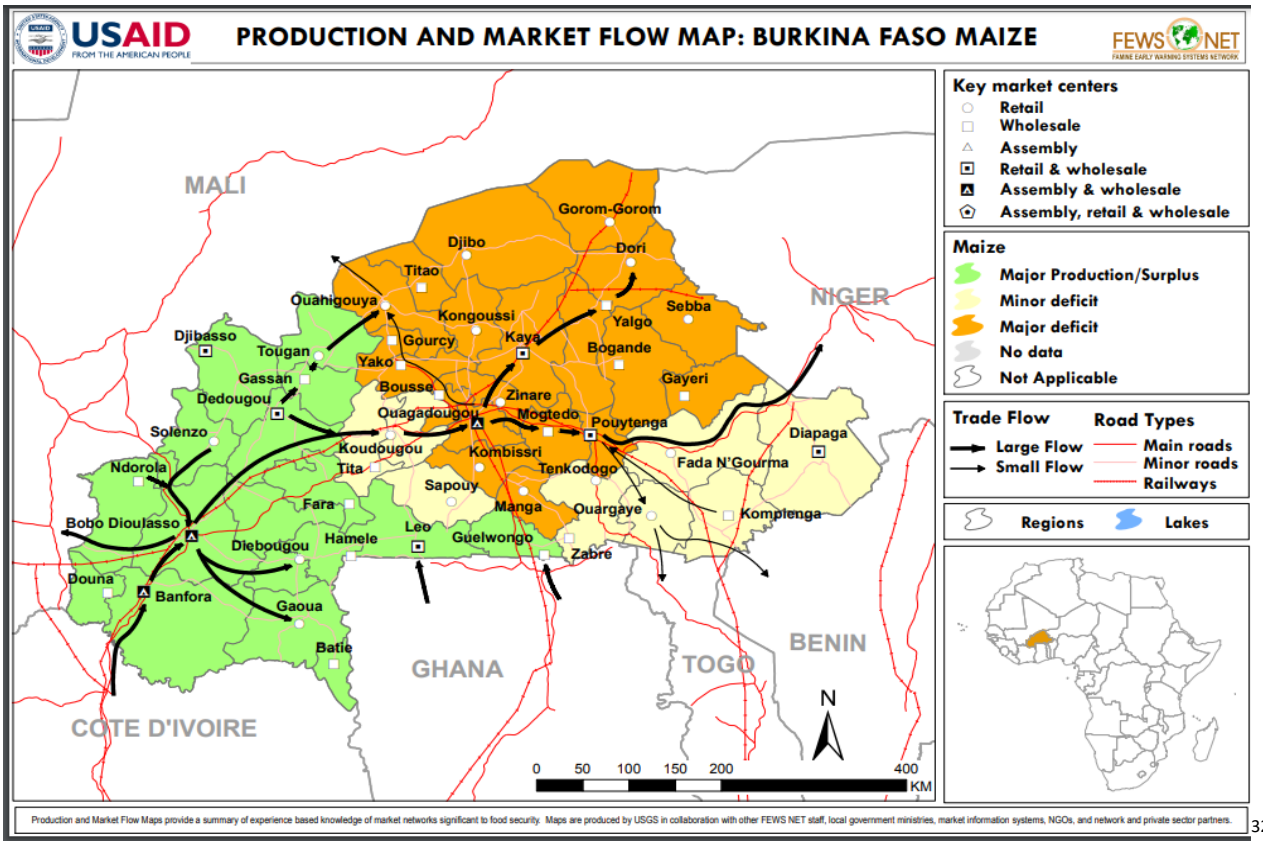
Electricity access and household income in developing countries. Note: The size of the bubble is proportional to population. Source: Data from IEA (2010). Redrawn by author.

Table 1

Electrification rate and population without access to electricity in 2000, 2005, and 2009. Source: Compiled by the author, based on IEA (2002, 2004, 2006, 2011).

Area	2000	2005	2009
	Electrification rate (%) Population without access to electricity (million)	Electrification rate (%) Population without access to electricity (million)	Electrification rate (%) Population without access to electricity (million)
World	**73%** 1645 million	**76%** 1577 million	**81%** 1317 million
Developing countries	**64%** 1634.2 million	**69%** 1569 million	**75%** 1314 million
Africa	**23%** 508.9 million	**26%** 547 million	**42%** 587 million

Figure 6

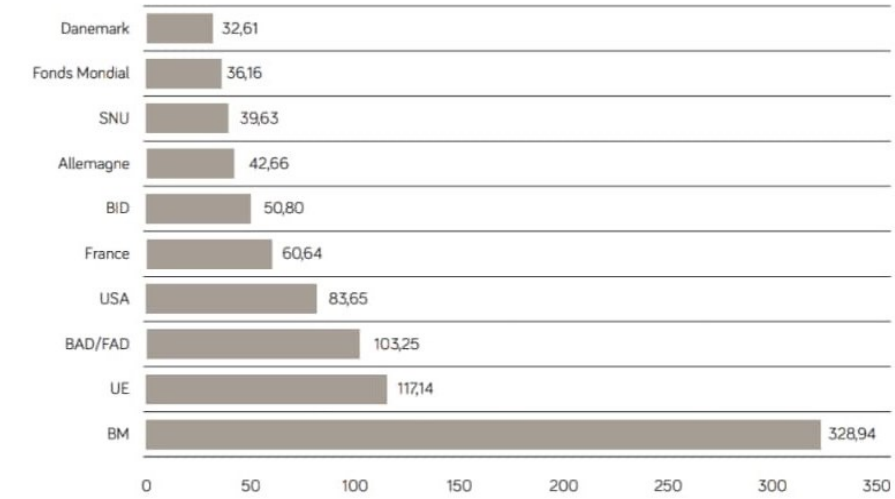


[32]

[32] Production and Market Flow Map: Burkina Faso Maize. https://fews.net/sites/default/files/documents/reports/bf_fullmap_maize_norm.pdf.

Figure 7

Graphique 5 : Contribution des 10 principaux bailleurs faisant de l'Aide projet sans fonds commun en 2018 (en millions de dollars US)



Source : PGA/DGCOOP, septembre 2019

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