# Prospects of Solar Power in Less Economically Developed Countries Using Tanzania as a pilot study

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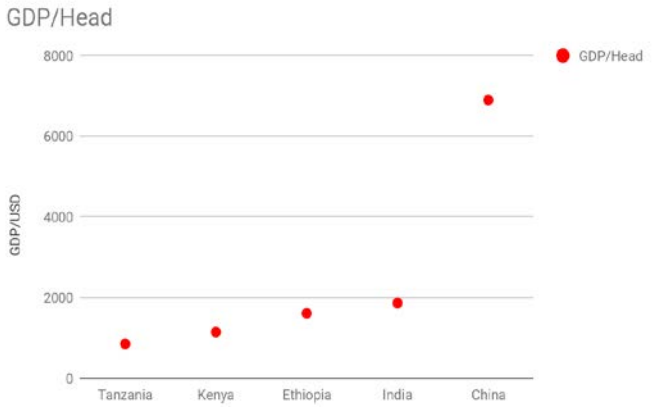
***Abstract-*** This paper focuses on the usage of solar panels to generate electricity in remote areas and less economically developed countries (LEDC's) with a specific focus on countries that lie along the equator, using Tanzania as a pilot study. This paper also examines and evaluates Saleh's (1978) research in which he states 'most of the developing countries lie within the "solar – belt" i.e., in the latitude range 35° N - 35 ° S which is characterized by the higher intensity of solar radiation.' Moreover, this paper also acknowledges that large scale operations such as the ones being undertaken in countries like India which seek to replace conventional regional grids with solar arrays are efficient and more practical for larger settlements, they are time consuming to construct and more expensive than the communities can afford. Additionally, this paper looks into the ideas put forward by Komendantova, Patt, Barras, & Battaglini, (2012) in saying that an absence of government guarantees is a barrier to the development of such technologies and projects in developing countries.

***Index Terms***- solar energy, remote areas, less economically developed countries, solar belt

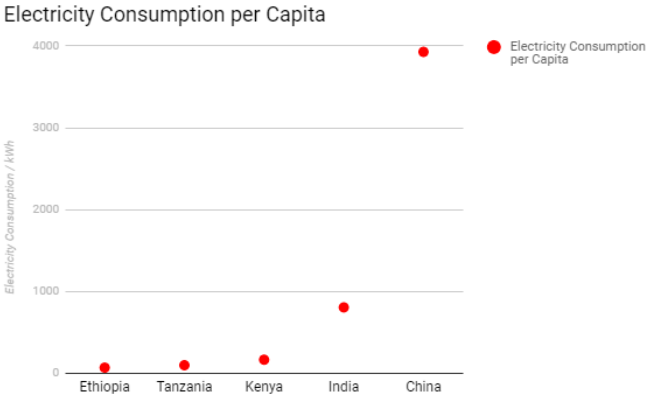
## I. Introduction

LEDC's tend to have a more than half of their population living in rural areas, with an average of 62.63% in Sub-Saharan Africa and 64.93 in Heavily Indebted Poor Countries (HIPCs), most in remote places which are inaccessible to proper grid electricity, thus rendering that many people with either no or very little amounts of electricity to use. This causes any sort of development in these regions to proceed much slower than in areas with electricity, (Kirubi, C., Jacobson, A., Kammen, D. M., & Mills, A., 2009), and hence the overall development of the country suffers as a majority of the population does not develop at the same pace as those that live in the urban areas. Moreover, it is widely documented that any inhabitant of these settlements with even the most miniscule ok skills leaves such places to find work in urban areas, which causes the already over populated urban areas of developing countries to increase even more in population without having the proper resources.

Taking the example of Tanzania, which is the pilot study in this paper, we find that it is in a very suitable location for solar power, as it is located in the solar belt, and hence solar energy is the most promising resource that the communities can use, with the lowest annual average of 15 MJ or 4.2 kWh/m2/day and the highest of 24 MJ or 6.7kWh/m2/day.




The GDP per capita of Tanzania is 877.5 US Dollars (USD), and hence many people are not able to afford the electricity that is provided by the main provider, TANESCO, which sells at 0.12 USD/kWh. Additionally, as most of Tanzania's population lives in rural and sometimes inaccessible areas, it is hard to establish any sort of formal electric grid to power the houses and communities in these areas. It is documented that of the rural population of 37,789,096, only 16.9% of that population, which is 6,386,357 people have access to electricity. It is evident that any form of centralized grid is not the answer, and that to gain access to electricity, such communities would have to set up localized grids and single unit solutions.




It is also a well-known fact that solar power and other renewable energy sources come at a much cheaper cost to the

environment and the consumers in the long run as there is only a set up cost as compared to regular payments. However, as the majority of the population live in areas which have rough terrain, it is obvious that the scale of such projects may need to be small. Moreover, given that Tanzania has two periods of heavy rainfall which causes any construction to grind to a halt, the timeline of such projects would also have to be between *1 to 5* months.
The solution is very clear in saying that alternative sources of energy have to be considered rather than nonrenewable ones. However, not all non-renewable sources can be used.

For example, windmills tend to be expensive and need a lot of manpower and skill to set up and maintain, and need flat land, which is hard to find.

Hence the cheapest and most efficient source of electricity would be solar power.

In terms of actual implementation of the same, there are many choices that can be made as to where the solar panels are to be sourced from: if the community wants/needs cheap panels, then Chinese panels would suffice; if the community wants quality (extreme remoteness, far from service centers in case of malfunctions or defects) then they should opt for European panels.

In Tanzania, there are many providers of solar power, some NGOs, some private companies.
These include:

- Mobisol
- Zola
- Power Providers

Additionally, there are small scale international providers such as Plug the Sun, which provides single unit solar solutions for small and poor families/communities, while being what it calls an *energy charity*. Plug the Sun also provides pay-to-plug services which provide electricity for a set amount of time for a small amount of money, which can be placed anywhere as they are small in size, and can be used as mobile charging ports around settlements, as most of the women living in these communities and settlements walk long distances to fetch water, and are afraid of not being able to be contacted during emergencies as their phones aren't able to be charged due to a lack of power.

According to its website, *'Plug the Sun's off grid solar panel kits are the perfect solution for the electrification of houses and villages. Powered by its proprietary integrated solar battery systems, our Solar Home Systems can be easily installed everywhere. Moreover Plug the Sun, thanks to its network, provide a* ***complete service for the installation of big quantities of these solar kits*** *in remote areas of the world.'*

It is taken into consideration that not all families are able to even pay for a single panel, low power solutions and for those families there are appliances which run on solar power, such as small lamps and fans which can be charged in sunlight when they run low on power, and hence they don't have to pay for any large solar panels. These appliances cost less than 10 USD, and are widely available in regional hubs.

Power Providers, another solar solutions firm based in Tanzania, have solar power kits starting from 2000 USD for small houses and going up to 20,000 USD for a bigger house.

As the people/communities who require such systems are poor, there are many microfinance companies and banks located in Tanzania that provide up to a five year loan to these people which they will be able to pay off.

## II. Limitations

As the weather in Tanzania is rather unpredictable, and the rainy seasons long and dark, there will definitely be times where solar energy may not be able to be generated and stored amounts will likely be used up. Hence other sources also need to be considered such as small scale wind energy and hydroelectric power.

Moreover, it is apparent that not all people will be able to or even want to afford these technologies and hence awareness about this issue needs to be raised in small settlements through government efforts.

The price of solar panels which last long, i.e. the European panels, are very expensive and even though the only cost that has to be faced is the initial installation charges, most people are turned down due to the daunting nature of that very cost, and as of right now, there are no tax cuts or other incentives to solar manufacturers to establish their factories in Tanzania which would drastically reduce the price.

## III. Conclusion

In spite of the above mentioned limitations, the benefits of of solar energy are so high that if the large companies are given certain government help for land, skilled labor and infrastructure it can definitely help the people of such countries to improve their socio-economic life, and moreover help such countries to improve their human development index to rise from their stagnant values around 0.5. In conclusion, such systems are the best hope that such communities have at a sustainable, healthy and bright future.

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