



# Tontine: Self-help financing for solar home systems



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## ABSTRACT

The main limitation for a consistent expansion of rural electrification in developing countries is financial. In this paper we propose a new method of financing to access solar home systems for poor rural areas of developing countries. We use the concept of Tontine that is a traditional self-help organization that can provide funds without guarantees or interest, to give access to electricity to those who could not otherwise. We have developed low cost solar home systems presented in this paper to embody our proposition. We have as well started a pilot project in Senegal. We present two basic forms of self-help associations that have saving and lending as a primary or sole function, Rotating and Accumulating Savings and Credit Associations, respectively under ROSCA and ASCRA acronyms. We have built and proposed two solar home systems in ROSCA scheme in this paper. System 1 features two 5 W LED lamps and a mobile phone charger. System 2 is smaller, it is based on recycled mobile phone batteries, it powers a 5 W LED lamp. In the pilot project, the tontine for system 1 is taken on one year period while system 2 is given on 5 months basis.

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## 1. Introduction

About one quarter of the world's population does not have access to electricity [1–5]. The low level of electrification in rural areas is a characteristic of number of developing countries. This is generally related to the high cost of the grid expansion combined with the insufficiency of energy resources. The priority demand for electricity in these regions is for lighting and telecommunication. Mainly, small private business owners collect fees to charge mobile phone batteries. In fact, in most countries, wireless mobile phone coverage is generalized even in the most remote villages that generally do not even have access to electricity. The solutions used for lighting are generally candles, kerosene lamps or solid-state batteries operated lamps. Such a situation affects many aspects of daily life especially safety, health, education and income generating activities that generally have to cease at night [6,7]. Another reality that generally characterizes the populations of rural areas in developing countries is their low incomes and savings [7,8]. Consequently, they cannot invest up front in an autonomous electric power system. The standard banking system does not attribute loans to these populations because of lack of guaranties. The conjuncture of the above listed problems should be the guideline for a targeted solution for rural electrification. Propositions above

the means of the populations so far did not lead to a successful implementation of available solutions.

In fact technical solutions exist, standalone solar photovoltaic or wind systems among others are well used in different parts of the World with great satisfaction, but generally they are not accessible to common rural populations in developing countries [9]. The failure for the generalization of rural electrification is partly explained by inadequate propositions and government policies. A number of businesses have opened to satisfy the rural market, but the statistics are still revealing that the problem remains widely unresolved [8,10].

A considerable amount of work, projects or other government policies and international organizations' initiatives have been deployed but one quarter of the World's population still lives without basic electricity commodities as decent lighting. The different models of rural electrification applied by private companies or public sector did not so far allow bridging the gap. Developing countries, mostly rural areas of sub-Saharan Africa and South-Asia, are those below the energy standards and where the largest proportion of the World live under the poverty line. These are countries with numerous challenges, weak economic and financial structures. Rural populations suffer of those weaknesses that do not allow them to improve their living conditions. Better financial conditions would have allowed them to benefit of the technologic advances as delocalized energy production units for low demand as for solar home systems in rural areas. The lack of

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electricity in rural areas of developing countries is a major factor hampering development. In fact, electricity could contribute considerably to development by increasing agricultural production and better living condition in rural areas as farmers could have an improved water management systems through irrigation, drainage, water logging or salinity control.

It is because of the limitations of the existing models that a different type of contribution is needed to face the hurdles of financial limitations in rural electrification. This is why we propose in this paper a model based on self help financing; it is socially sound and bypasses the financial limitations for small solar home systems.

Our model does not pretend to be the ultimate solution for rural electrification in developing countries, for places even with a good solar potential, the tontine model presented here is not always adequate as it depends on the revenues of the populations and their capacity of contribution. New models of development and access to energy are necessary to face the immense needs for villages in developing countries to have solutions to the energy needs for development and better living conditions.

## 2. Off grid rural electrification models

There are two main financial models for the large-scale development of rural electrification; the fee-for-service model and the micro-credit scheme [11–13]. The choice of one model over the other changes from one country to another, it may even change from one region to another within the same country. Furthermore, it will depend mainly on the local available finances.

It appears that the fee-for-service model was first introduced in the Pacific region, where small cooperatives were launched in the 1980s [14]. In Africa, Morocco has a wide experience in hybrid solutions combining a mix of solar and diesel systems, it allowed achieving a high rate of rural electrification. In Southern America, rural concessions started for example in Argentina in the province of Jujuy since 1999 [10,15].

On the other hand, numerous programs based on micro-finance institutions for the funding of rural solar home systems have successfully supported the expansion of solar rural electrification, mainly in South Asia, as in Indonesia, Sri Lanka, the Philippines, Bangladesh, India and China [16,17].

An alternative to these two main models, the cash and carry model is in favor of the development of smaller systems generally providing only lighting which could be affordable without credit. Such a model generally carried by the private sector, has been very successful in Kenya for example [18].

From an organizational point of view in the fee-for service model, energy companies that have to collect fees, remain the owner of the installed equipment and are in charge of maintenance or repair if necessary. In the micro-credit scheme they can leave the task of fees collection generally to micro-finance institutions and deal only with installation and maintenance of the systems; in this case the systems are sold to the final users. The two groups need to work in tight collaboration to have a successful model.

For a universal access to electricity without grid extension in rural areas of developing countries, it appears that selling upfront complete solar home systems directly to the rural end users is inadequate, the fee-for-service model or micro-credit model may need to be adopted. In remote rural areas another problem rises for system owners: the lack of service. For those who can afford it, number of systems in these remote rural regions is out of use because once a breakdown occurs; the technical repair service or parts are not available.

A fee-for-service model is very realistic to overcome the problem of rural electrification in small isolated villages without any

technical resource and where neither standard bank loans nor micro credits are available and incomes too low to buy up front a solar home system. But in this case the main issue is to have a company that will commit in this form of rural electrification and have a large national coverage considering the slow return on investment in addition to the risks of default payments.

The first step for a successful generalized solution should be the quantitative evaluation of the energy needs in rural areas and compare them with the average income of the populations. The fees to receive an electricity service should be based on incomes and populations' current expenses in energy.

The model adapted for rural electrification should in any case consider two main points. The first one is obviously due to the financial restriction of rural populations who cannot pay up front for a product beyond their revenues and do not have access to any loan [8]. The second reason is that when the system is the property of the rural user, in case of breakdown the lack of human resources and qualified repair services will leave the unit nonfunctional.

As described above the classical off-grid rural electrification models all present limitations due to access to finances. Even in the cash and carry model that deals with smaller systems and supposedly more affordable, the buyer pays up front; that often demands some saving considering revenues in rural areas of developing countries. This justifies the necessity to engineer a model that can bypass the financial issue that so far hinders the expansion of rural electrification. This is why we introduced a new model that is socially sound and can be applied without any financial institution, tontine, a self-help financial system for solar home systems.

## 3. Issues in financing rural electrification

Rural electrification is generally not considered as a profitable market, particularly in developing countries. The clients' physical remoteness, the low density of population in rural areas and low power demand contribute to increase, for an important portion, the per capita and per kWh cost of installation, distribution, maintenance and risk. Consequently, rural electrification is not considered as a priority by the private sector, particularly when after initial private investment decreased due to poor returns and uncertainty about possible regulatory changes [19]. Globally, tariffs have increased in developing countries while in some cases rates of rural electrification have experienced sharp drops and the evolution of electricity consumption has declined as a result of reforms [20].

Sustainable financing is often the most challenging part of rural electrification because of the nature of the question itself. Rural electrification finances are generally issued by cooperation agencies, international organizations, regional or bilateral financial institutions, local or national governments and banks and other local sources [21–23]. Due to market inadequacies in opposition to the importance of access to electricity [24,25], governments of some emerging or developing countries such as Brazil and Peru subsequently reaffirmed their role as key suppliers in rural electrification. For the rural electrification market, they introduced specific laws, regulations, funds, subsidies and authorities, thereby improving their institutional frameworks to better meet service expansion needs [20]. Government should be the key player as the rural electricity regulator; access to quality electricity service should be a right granted to any citizen as a human right and should not be regulated only by market rule of demand and supply. Rural electrification has not so far been successful under the unique market law of demand and supply. To successfully finance rural electrification models and projects, primarily an adequate policy is needed. The appropriate subsidization process and mechanism is crucial, but in itself a subsidy does not necessarily lead to successful

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