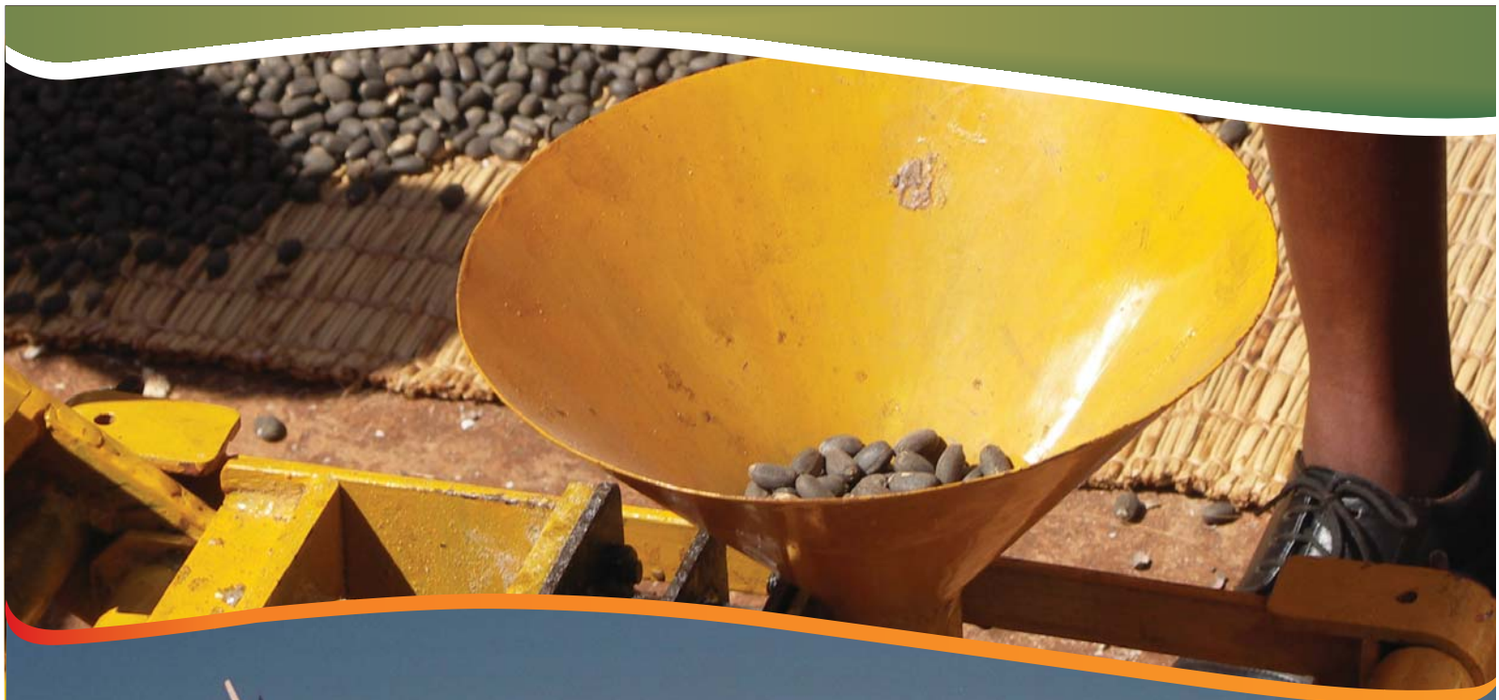


RENEWABLE ENERGY TECHNOLOGIES FOR RURAL ELECTRIFICATION. THE ROLE AND POSITION OF THE PRIVATE SECTOR

RENEWABLE ENERGY TECHNOLOGIES FOR RURAL ELECTRIFICATION - THE ROLE AND POSITION OF THE PRIVATE SECTOR[1]

[1]Within this context, by Private Sector, we refer to industries active in the field of renewable technologies such as manufacturers, distributors, system designers and operators and providers of services.

INTRODUCTION

1.6 billion people worldwide[2] do not have access to electricity in their homes, representing more than one-quarter of the world population. Furthermore, according to the International Energy Agency (IEA), world electricity demand is expected to double between now and 2030[3], with most of the growth occurring in developing countries where electrification rates are not keeping up with population growth.

Currently, four out of five people without electricity live in rural areas of the developing world, especially in peripheral urban and isolated countryside areas, which are often geographically secluded or sparsely populated. Current patterns of energy supply are not able to provide electricity to these communities; due to low potential electricity demand and economic development in these areas and sometimes also for political reasons, grid extension is not a feasible option.

A total capital investment of 8.1$ trillion, equivalent to an average of $300 billion per year, is needed from 2003 to 2030 for the developing and transition economies to meet their energy needs, of which electricity comprises approx. 73%. It is clear that these needs cannot only be covered by public funds, including donors and governments; indeed, according to the current levels of investment in the electricity sector; only about 50% of the needs are financially covered, that is, about $80 billion per year out of $160 billion per year[4].

In sum, there is a huge investment gap, and an urgent need for finance for the electricity supply sector in developing countries. At the same time, new technology approaches are needed to increase the production of electricity in rural areas and to improve the living standards of millions of individuals.

Private actors active in the field of renewables are often a **source of technological solutions and innovations**. Indeed, Renewable Energies Sources (RES) are currently one of the most, if not the only, suitable options to supply electricity in fragmented areas or at certain distances from the grid. Decentralized (off-grid) Rural Electrification based on the installation of stand alone systems (Photovoltaic [PV], Wind, Small Hydropower [SHP], Biomass) in rural households or the set up of electricity distribution minigrids fed by RES or mixed (RES-LPG/diesel) plants, will allow for the provision of key services such as lighting, refrigeration, education, communication and health services, thus increasing economic productivity and creating new income generation opportunities. Further, the technologies which are used to power off-grid applications are often affordable and environmentally sound.

Despite this, however, Renewable Energy is often still perceived as the high cost option, but the truth is that the high capital costs of installing Renewable Energy systems are frequently inappropriately compared to the capital costs of conventional energy technologies. In many cases, particularly in remote locations, the low operation and maintenance costs, as well as the nonexistent fuel expenses and increased reliability and life span of Renewable Energy Technologies (RETs) offset the high initial capital costs. Sadly, this kind of life cycle accounting is still not regularly used as a basis for comparison. Furthermore, the externalities associated with energy systems, especially the environmental costs associated with fossil fuels, are often not properly accounted for.

The private sector can be also a **source of investment capital** that is, sometimes, not available in the public sector, although the financial performance and viability of the installed system still decides their degree of involvement. In many cases, the absence of an appropriate legal, regulatory and financial framework to attract foreign or domestic investment discourages any initiative on this field and, consequently, hampers the access to energy.

[2]Source IEA – World Energy Outlook 2004
[3]Source IEA
[4]Source: Clean Energy and Development: towards an investment framework – Environmentally and Socially Sustainable Development. Vice Presidency Infrastructure Vice Presidency. The World Bank, April 2006.

PRODUCTS FOR RURAL ELECTRIFICATION

The reality is that the private sector is already stepping in to fill the gap of the communities left in the dark by bringing equipment, expertise, specialist knowledge and more effective management. PV, Wind, Solar and SHP systems have been successfully installed in different developing areas such as Morocco, China, Senegal, Ecuador, Mexico, and many more. Likewise, hybrid village electrification systems have also been implemented in Ghana, Tanzania, South Africa, and China, among other countries.

A wide variety of services and innovative products are currently offered by renewable industries for off-grid applications, including plant design, production and supply of system components, installation and commission of systems, operation and maintenance, turn key project realisation, village electrification, training activities, etc.

These technologies have been designed to satisfy the energy needs for households, enterprises and communities in rural areas by making a responsible choice of components (usually standardized system components) of high reliability with minimum maintenance and maximum performance.

A number of commercially feasible products/system components are currently supplied for off grid applications, such us PV modules, small wind turbines, towers, small hydro turbines, inverters, charge controllers, solar home systems, system technology, software application, wind and solar pumps, storage tanks, batteries, support structures, etc.

Small hydro turbine T5 - POWERPAL

Jatropha-ENERGIEBAU

Likewise, a number of decentralized systems have also been developed by the same actors, namely:

Battery charging stations: PV and wind battery stations are increasingly used to replace gasoline and diesel-fuelled gensets to charge the automobile batteries that are widely used to run household and community facility lights, radio or TV.

Individual appliances: there are a number of Solar Energy appliances commercially available, including solar flashlights, solar-powered radios or solar-powered vaccine refrigerators.

Commercial packages: they are supplied either in kit form, or with installation and maintenance services included. These options include, for example, street lighting packages; ice makers for preserving perishable products; Solar Home Systems (SHS) - normally designed for standard requirements like lighting, refrigeration, water pumps and entertainment equipment-pumping kits or professional kits - mainly designed to operate applications like telecom, television repeaters, monitoring and security systems, lighting and signaling.

Tailor made PV and wind generation units are also commercially available with battery storage (if needed) and the necessary appliances configured for specific applications. Such systems are mainly used to provide water (comprising water pumping, cleanup, disinfection, purification, distribution and storage) and power for schools, clinics, shops, telecommunications, internet and small offices. A tailored package for a health clinic might include

conventional lighting, specialized high-intensity bulbs, an autoclave (for sterilization of surgical instruments), a vaccine refrigerator, a water pump and a short-wave radio.

Micro-grid and mini-grid systems: there are currently many small-scale grids serving a village or a cluster of buildings, including a school, a community centre, some shops, and providing energy for lights, communications, entertainment, water pumps, water purification systems, refrigeration units, freezers, ice-makers, grain grinders, etc. These can be powered by a variety of commercial Renewable Energy-based technologies, including hybrid power systems in combination (Wind-Solar, Wind-Diesel, Solar-Diesel, SHP-Solar...) or with fossil diesel and Liquefied Petroleum Gas (LPG) generators.

ISA 30K hybrid - CONERGY
Charge Controller - ISOFOTON

PV wind hybrid system - BERGEY

Battery charger - ECOTÈCNIA
PV wind hybrid system South Africa - SMA

SERVICES FOR RURAL ELECTRIFICATION

More and more, Renewable Energy industries are defining their **services** to allow for a **sustainable and efficient operation of the systems** and equipments they provide. The most critical question is, therefore, how the systems will be maintained and operated on a sustainable basis. The answer to this question lays in the provision of reliable equipment, the availability of spare parts, market-driven/commercialized Operation and Maintenance (O&M) models, appropriate training and transfer of knowledge, and a reliable service network made up of strategically partnerships.

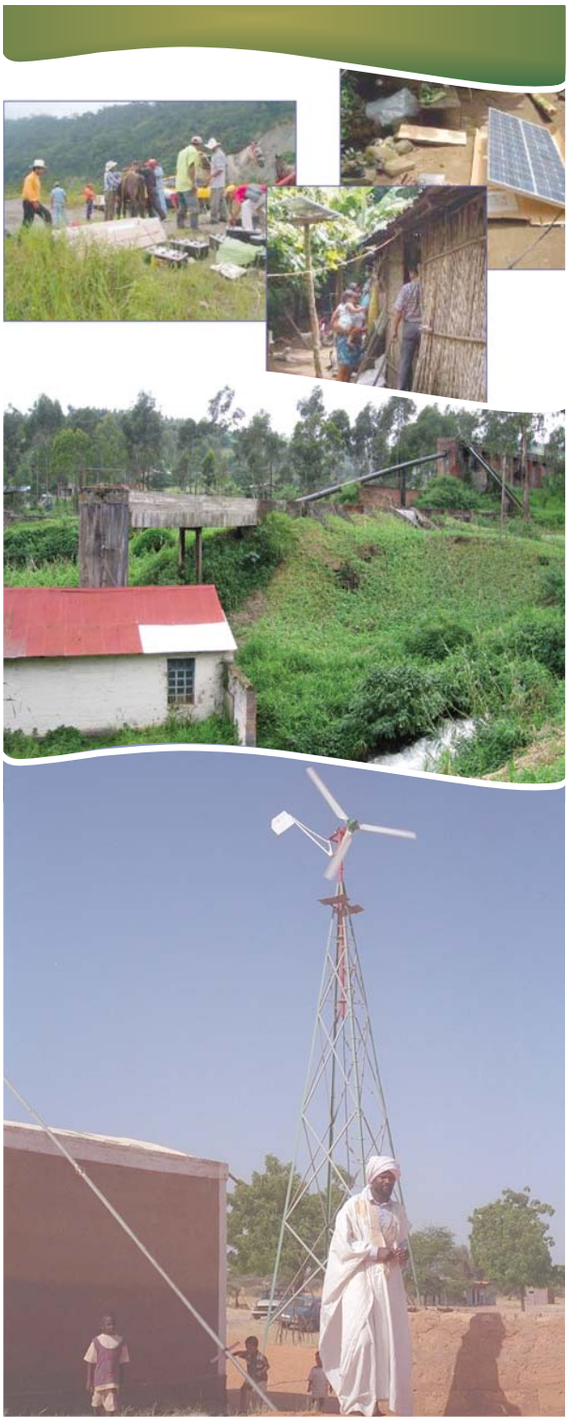
Training is a key issue for the successful development of Renewable Energy systems. Rural salesman, local installers, technical personnel as well as users should be trained on the importance, use, operation and maintenance of Renewable Energy systems.

Therefore, in addition to a detailed operation manual, the system designer/installer must also provide the appropriate training on how to operate and maintain the equipment; local service engineers should be capable of repairing the system components in case of malfunctions and system operators should be familiar with the basic operation of the systems.

Targeted workshops, on line tutorials, support hotlines for off grid customers, dedicated training centers or on-site specific training are some of the means used to guarantee the optimal performance of these systems.

Solar Coach training system, Tanzania - ENERGIEBAU

SHP power plant, Rwanda - MHYLAB
Solar water pumping – PHOTOWATT
PV system for telecommunication - SMA



SHS, Mexico - CONERGY
Small hydro power plant - MHYLAB
Stand alone wind system, Mauritania - FORTIS WIND

Technology/know-how transfer is also critical to guarantee the sustainability and optimal performance of Renewable Energy systems, constituting also an essential source to build up knowledge within developing countries eager to launch their industrialization.

A transfer of technology and/or know-how can be shaped in different ways depending on the desired degree of involvement of the industry (technologically and financially), the aiming/targeted market and the existing legal and administrative frameworks (mainly to avoid the infringement of intellectual property rights and endless administrative procedures). Technical assistance, know how contract, award of licenses, training, subcontracting, franchising, joint ventures, subsidiaries, are some of the approaches currently used.

The development of **public/private partnerships** will also contribute to stabilize the market and to put into place a successful technology transfer. Many combinations are possible to implement successful partnerships, i.e. local authority/foreign company, private company/local utility, Renewable Energy Service Company (RESCO). The private sector can offer skilled personnel and management skills and new technological approaches whereas the public sector can provide stability and risk reduction, skilled personnel to collaborate with private sector and incentives to mobilize stakeholders.
Finally, business practices and strategies are quite different between western countries and developing countries, therefore, the cultural background, social habits and economics practices of the partners involved will have to be preliminary addressed to put in place a successful partnership.

Solar PV system, South Africa - GREENPEACE

THE CHALLENGES AHEAD

The technology is mature and ready to play a significant role in the electrification of rural areas within developing countries. Further, the industry is currently engaged to also provide the necessary training, transfer of knowledge and capacity building on the operation and maintenance of the systems.

However, there are still a number of challenges to face in order to reach a fair level play scenario for Rural Electrification:

• Despite of the favourable characterisitcs of RES, they are still perceived as high cost options and therefore limit public and private investment in off grid applications. The reasons can be found within the benefits enjoyed by the conventional energy systems such as favorable policy frameworks and public financing advantages, giving as a result low capital costs, thought leaving the evidence of significant operating costs. Renewable Energy systems seldom enjoy direct or indirect subsidies, because of their environmental benefits. Also, many Renewable Energy products are subject to import duties and taxes.

Therefore, appropriate **support frameworks** should be developed to internalise social and environmental costs and to remove market distortions, including the restructuring of taxes and the phasing out of harmful subsidies. Further, **financial tools** from governments and multilateral institutions, based on proven models and innovative financial mechanisms, should be further developed to provide defined and stable returns for investors and compensating high capital costs.

• Renewable Energy systems are mainly funded by governments, which usually consider its social impacts but frequently ignore the importance of sustainable long-term operation. People will be back in the dark sooner or later if the system can't generate positive cash-flow to support its long-term operation. The truth is that electricity tariffs often result in insufficient revenues for system operation, but, at the same time, they should also remain affordable for the end consumer.

Therefore, the **electricity tariff** charged should be designed to, at least, **cover on site management and security, O&M costs, replacement costs (ex.batteries), administrative costs (tariff collection, etc)**. Additionally, **commercial loans and credit schemes** should be designed to allow the end consumer to afford the required initial investment and the subsequent payment of the electricity bills.

• Renewable Electrification systems are often theoretically owned by initial funding agencies, but physically owned by the benefited users. Confused ownership arrangements can swiftly lead to short cuts on operating practices and long term maintenance. The resulting situation has posed serious challenges to the sustainable operation of many existing village power systems.

Therefore, **ownership should be clarified**. The final users and system manager (operator) should be encouraged to take also responsibility for the system long term operation.

• There is a continuing distrust of international investors towards the developing institutions and how they function. It is well known that a number of developing countries lack the conditions to attract private foreign investment, such us a secure environment, economic and political stability and a supranational system for resolving disputes which ensures a fair process to the investors. Without a minimum level of transparency and stability, investment in Renewable Energy, indeed in any other sector, is not a realistic option.

Therefore, **reliable policy and legal frameworks** should be developed taking into consideration the significant potential role of the private sector in Rural Electrification. Regulations are required to reassure the private sector of the extent of its legal legitimacy to operate in the energy field and to ensure the safety and protect the rights of consumers of electricity. A clear and transparent legal framework, at least locally, is necessary, including a Rural Electrification energy planning based on Renewable Energies.

• Infrastructure and availability of spare parts in remote areas is usually insufficient to guarantee and uninterrupted energy service when low quality components are used.

Therefore, **clear industry standards are needed** to prevent unreliable and poor quality equipment from entering the market place. Standardization bodies for the different technologies are needed and certificates should be provided upon a level of technical performance, including standardization of hardware and software.

Rural Electrification in Bénin - M. Courillon - ADEME

FACING THE CHALLENGES OF RURAL ELECTRIFICATION

The **Alliance for Rural Electrification (ARE)** was created in response to the need for access to sustainable electricity in the developing world, and to facilitate the involvement of ARE members in emerging rural energy markets.

The greatest strength of the ARE is its robust industry-based approach, coupled with the ability to combine different RES in order to provide more efficient and reliable solutions for Rural Electrification. ARE is only committed to technologies that meet quality criteria in terms of long term performance, environmental durability and safety.

Factory - ISOFOTON

The products and services described in this document come from ARE members and supporters. The challenges that Rural Electrification is currently facing, as well as the recommendations also come from their experience and expertise.

ARE, together with its members will continue to work to provide sustainable access to electricity to rural communities in the developing world and to push forward the development of transparent decentralized electricity markets, designed to respect both supply and demand, in order to achieve stability and ensure consumer access to electricity.

Furthermore, ARE is ready to cooperate with multilateral organizations, donors, financial institutions to prove to them the existence of commercially viable off grid markets and to develop financial approaches suited to the scale and characteristics of Renewable Energy.

UN - GENERAL ASSEMBLY
European Parliament

CONCLUSIONS

Given the generally low grid-connected electricity rates in the developing world and the need to scale up the financial assistance and investment to electrify rural areas; the financial and technical involvement of the private sector with a Renewable Energy based approach is necessary to contribute to significantly increasing the electrification of rural communities.
The private sector has developed pragmatic approaches with proven results. Although modest when compared to the challenge of poverty alleviation, it has achieved certain successes in reaching rural communities and developing energy security. As a result, there is a large and growing set of choices of commercially-available and field-proven Renewable Energy systems based on Solar, Wind, Biomass and Hydropower resources. Further, proper training in operation and maintenance for the actors involved, such as end users or local technicians to achieve optimal performance of the systems, also need to be part of the services provided to successfully electrify rural areas.

But still, a growing involvement of local, national and international financing institutions and donors, together with the development of specific support frameworks, innovative financial tools, a balance electricity tariff and clear industry standards, are necessary to provide to the private sector the confidence to invest in Rural Electrification and to help to mitigate the bigger risks involved.

ARE firmly believes that RETs are the adequate solution to address the specific energy and water needs in rural areas, and it will dedicate its efforts to:

- Increase society's awareness of the potential or Renewable Energy in the fight against poverty.
- Accelerate the deployment and use of new RETs within developing countries.
- Prove that Renewable Energy technologies are mature enough to provide reliable, clean and sustainable electricity.
- Stimulate the private sector involvement (technically and financially) in the developing world.
- Generate financial resources for Rural Electrification.
- Promote and support the development of healthy decentralized energy markets.

THESE ARE THE INDUSTRIES THAT HAVE ALREADY SUPPORTED THIS PAPER:

JOIN THEM.

Alliance for Rural Electrification
Shining a Light for Progress

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