

**GENERAL CONSIDERATIONS AND PLAN OF ACTION
FOR MASS INTRODUCTION OF RENEWABLE ENERGY
TECHNOLOGIES IN NEXT MALI 5 YEAR
DEVELOPMENT PLAN**

Cheickna Traore and Modibo Dicko
Laboratoire National de l'Energie solaire de Mali

ABSTRACT

A major programme is now underway to promote greater use of renewable energy resources in Mali. Current activities to assess the potential for using solar, wind and biomass resources and to develop technologies are described. The Mali National Solar Energy Laboratory has designed and now manufactures various pieces of equipment. The current Mali five year plan includes a comprehensive renewable energy programme within its overall plan to promote self-reliance and economic and social development.

INTRODUCTION

In addition to hydroelectric power, renewable energies (RE) are the only national energy resources in Mali. Over 50% of Mali's export receipts go towards oil imports. There are a number of constraints beyond governmental control that limit the exploitation of hydroelectric power. However, there is much potential for exploiting other RE resources. The following sections indicate directions for integrating RE into the most recent five year plan for the economic and social development of Mali.

ENERGY

Petroleum products

The country is entirely dependent on imports. Because of the steady increase in oil prices since 1973, the country cannot meet its needs in accordance with the desired development. From the 1960-70's to 1981, the percentage of imported energy costs compared to Mali export receipts increased from 25% to nearly 50%. The total consumption of these products was about 190,000 tons in 1980 for an annual consumption per head of 28Kgs (one of the lowest rate in the World) compared to respectively 1,100,000 t and 134 kgs in the Republic of Ivory Coast for example.

Hydroelectric power

Mali has at least 17 sites with potential capacities of over 1100 MW, but the possibilities of exploitation are limited because of technical constraints and the high costs. The highly centralised nature of production is incompatible with the decentralised nature and generally low needs of a vast country with a largely (90%) rural population. The Selingue hydroelectric power station illustrates this. In service since 1980 only about one third of its 44 MW power is presently utilised.

Renewable energies

Solar energy

The level of insolation in Mali is one of the highest in the world (on average 4.8 to 6 kwh/sq m/day). For instance, about 20 sq km of photovoltaic cells displayed to such an insolation are sufficient to provide about the equivalent of the country's general consumption of petroleum products and about 1 sq km the equivalent of the total electric energy consumption.

Wind power

Wind speeds average 4-5m/s in areas north of the 14th-15th parallel (Mopti - Timbuctu - San-Nioro). In the centre of the country (including Bamako - the capital city - area) with speeds of 2 to 3 m/s, it can still be exploited. The speeds reach their highest in January and their lowest in October. This distribution, which is the opposite of that of the solar energy, allows a certain complementarity between these two sources.

Biomass energy

In general, the areas where this form of energy would be important are the north of the country and the "Delta Du Niger" (from Macina to Timbuctu). The estimated reserves are quite large, in the range of 1,300,000 TEC/year (TON - Equivalent - Oil). The sole bridge of Manantali is expected to supply 250,000 TEO of wood.

Wood

Wood meets over 90% of the population energy needs. The pressure on the forests due to population growth (2.7% in 1980), coupled with the low rates of regeneration mainly caused by the draught, have led to large scale deforestation. This may become irreversible if the next Mali development plan were not directed towards radical solution. The need for wood for Bamako (BKO) alone will increase from 200,000 in 1982 to 500,000 tons in 1990, whereas prices will go up by 15% a year.

General features of renewable energy

The nature and the considerable potential of R.E make them a major source of national wealth. Their exploitation is appropriate to national development which is directed towards two main targets: self-reliance in food and the fight against desert encroachment. The uses already made of these energies in Mali show the role that they can and must play in achieving these targets.

USAGE OF RENEWABLE ENERGIES IN MALI

Solar photovoltaic power

Solar cells are in use for lighting systems in BKO, Kati, Niore and in some schools and rural sanitary units. Solar fridges (in some dispensaries, including Niore, Ouellessebougu, Gao) are used for the preservation of vaccines. In the hospital in San, sterilisation of material and pumping rely on solar energy. Solar pumping is the most common usage of solar energy in Mali. About 100 solar pumps are already operating with a peak power output of over 100 KW. The first

has been in operation since 1977. The equipment is reliable and economic to run. Two grinding solar mills are operating in Bourem in Aly and in Tonfa (200kgs ground millet/day with a power of 2.6 KW).

Solar chargers of rechargeable batteries designed and made in the Mali National Solar Energy Laboratory (SEL) are available for sale. The wide availability of this product will lead to a reduction of household costs especially in rural areas and to a fall in the considerable importation of dry cell batteries.

At least 25 telecommunication and signalisation systems are already operating in Mali (at R C F M - Railway Company - Police Headquarters, airport). The Post Office has been using solar energy to supply all its isolated stations with energy for some time.

Solar heat

Solar drying sheds for many kinds of products (fish, meat, vegetables, fruit, gypsum etc) are being used in many localities (Mopti, San, Gao, Bamako) as well as solar distillers (San, Gao, Nioro, Bougouni).

A solar water heater was the first solar device produce by the SEL. It has been on the market since 1975. Its wider availability could result in a twofold advantage: fall in currency export as a result of the end of importing electrical water heaters and then reduction in electricity consumption.

Solar stoves are a radical solution to the problem of deforestation. Action must be taken especially to ensure its acceptance by the population. It is already being used in some rural training centres (CAR).

Wind power

A windmill used for pumping (4 m diameter wheel) has been operating for some months on a well of 25m in a field in the vicinity of Bamako. It produces 2 to 3 cubic metres/h. Five others are being made entirely by the Solar Energy Laboratory for needy areas. Aerogenerators yield power from wind. It is an excellent solution for isolated and windy areas. Investigations are in progress at the SEL, and there is a possibility of cooperation (for local production) with foreign companies specially one Belgian firm.

Bioconversion

Improved wood stoves

More than 1000 portable improved woodstoves (PIS) have been diffused by SEL in the areas of Gao, San, Bougouni and Bamako. Others have been distributed by the Peace Corps and volunteers from other countries, in other regions, particularly in Bandiagara. The wider availability of PIS is a problem of strategy: to mobilise the population; to organise production; to find better ways of selling and financing all the steps of an operation at national level. Finance has been secured for a project in Bamako. This will be the first step towards solving the numerous problems and lead to systematic and quick popularisation of this product.

Biogas digestors

About 20 are already operating in BKO and Koutiala. SEL is about to install six more in other localities of the country. The gas is used for lighting, cooking, refrigeration, pumping, grinding of grain etc.

Gasogenes

Four generators are already in use producing gas to be converted to power (at the office du Niger at Dogofry). These installations use waste materials from agriculture or agro-industrial production. The generators have reached a level of reliability which allows the popularisation of the process. This opens up important prospects for energy saving in the agro-industry. Mali is participating in the World Bank programme on evaluation of the existing gasogenes, for precise recommendations for diffusion.

Renewable energy is already being developed and exploited in Mali. Mali is one of the leading developing countries as far as efficient use of these energies is concerned. In many cases RE solutions have proved more reliable and profitable (pumping, telecommunications, signalisation). In other cases, only vast diffusion, technical improvements and conditions for a large scale production will bring down costs and make these energies competitive.

At present, RE represents the only possible solution to the energy crisis in many countries. For instance, for the preservation of vaccines in several sanitary units, mechanisation (solar mills) for villages. Can we estimate the number of human lives saved, of alleviated suffering, of time saved and being more efficiently used by women for more productive activities (economical, cultural, social - children education for example) through appropriate introduction of RES?

EXTENSION PROSPECTS OF RENEWABLE ENERGY

All the information given earlier, have accounted for the political decisions of the CEAO (West African Economic Community) to create CRES (Solar Energy Regional Centre) with its production firm and to launch under the supervision of this institution a regional programme for R E equipment.

The elaboration of the national Malian part of this programme has mobilised all the country's sectors of development. The national R E equipment programme has been worked out at a highly appropriate time in order to contribute to the next five years' plan for economic and social development.

The R E programme has been designed within the framework of the Mali national strategy for integrated development from the bottom up and on the basis of national priorities which are:

- In the economic field: self-reliance in food, mastery of water and the strengthening of experience in the reconstitution of cattle; the fight against desert encroachment; the fight to overcome the problems of a land-locked country; the association of the private sector with national industrial development.
- In the social field: to facilitate access to basic education for the majority of the population at school age; to improve and develop health.

- In the energy field: to promote to the optimum development of local energy resources (hydro-power and R E) and that of a better utilisation of energy in all its forms.

In order to reach the targets of this development policy, it will be necessary to consider the possibility of a significant contribution of R E towards meeting development needs. The proposed measures in order to reach these results involve not only local mastery of R E technologies, but also the implementation of all the necessary accompanying actions in motivating, training and maintenance.

The national R E equipment programme (15 well designed, well studied and costed projects) involves all sectors of the economy, as well as all the usages mentioned earlier.

Provisions are being made to equip 1700 villages with RE technology to promote self-reliance in food and the master of water. Against desert encroachment, the programme wants to promote the development of the PIS and the massive introduction of solar and biogas stoves. To overcome problems associated with being a land locked country, independent energy systems are to be installed for telecommunications, the beaconing of airports, radio communications and sign posts on railways. Other targets include:

- Energy savings in the agro-industries of the Office du Niger through the substitution of imported oil by locally produced products, eg alcohol, thus saving 1 million litres of oil per year.
- Saving by households on the cost of wood by using the PIS.
- Job creation to assure the production and the popularisation of the PIS and other R E equipment and their maintenance.
- The improvement of social and economic well-being of populations: (health, education, cultural activities).

The national R E equipment programme which was published as a document, gives detailed information about the projects which have been considered and given priority. It lasts from 1984 to 1989. Its total cost is 13,321,500,000 F CFA, including 11,015,700,000 for R E equipment. The financing needs are estimated at 12,462,600,000 F CFA while the population is expected to contribute 329,050,000 F and the government 529,850,000 F.

CONCLUSION

The national R E equipment programme is the result of a planning study of energy devoted mainly to R E. In energy planning, the philosophy, the approach and the methods differ. The introduced programme will be appropriate for the needs of a land-locked developing country which suffers permanent drought.

The exploitation of national renewable energy resources is one of the objectives in the overall national strategy for economic and social development. It lies with the government to ensure its effective implementation. Only imagination and a political will to develop in the first instance our local resources can give the right and long-lasting solutions.