

**GLOBAL  
ENVIRONMENT  
FACILITY**

**Mauritania**

**Decentralized Wind Electric Power for  
Social and Economic Development (Alizés-électrique)**

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**Project Document**

*This Project Document has been edited to facilitate public dissemination.  
The original is on file in the GEF Office at UNDP Headquarters in New York.*



## CONTENTS

|  |     |
|--|-----|
| Project Information  | 1   |
| A. Context   | 2   |
| 1. Description of subsector  | 4   |
| 2. Host country strategy   | 5   |
| 3. Prior and ongoing assistance                                      | 8   |
| 4. Institutional framework for subsector                             | 11  |
| B. Project Justification   | 15  |
| 1. Problem to be addressed and the present situation                 | 15  |
| 2. Expected end-of-project situation                                 | 18  |
| 3. Target beneficiaries  | 19  |
| 4. Project strategy and institutional arrangements                   | 19  |
| 5. Reasons for GEF assistance  | 30  |
| 6. Special considerations  | 31  |
| 7. Coordination arrangements   | 39  |
| 8. Counterpart support capacity                                      | 40  |
| C. Development Objective   | 41  |
| D. Immediate Objective, Outputs, and Activities                      | 42  |
| E. Inputs  | 82  |
| 1. Government of the Islamic Republic of Mauritania                  | 82  |
| 2. Beneficiaries   | 82  |
| 3. Global Environment Facility                                       | 82  |
| F. Risks   | 85  |
| G. Prior Obligations and Prerequisites                               | 86  |
| H. Project Review, Reporting and Evaluation                          | 86  |
| I. Legal Context   | 88  |
| J. Budget  | 88  |
| K. Annexes   |     |
| 1. Project and Task Organization                                     | 93  |
| 2. Evaluations and Reports   | 94  |
| 3. Training Programme  | 102 |
| 4. Memorandum of Agreement between UNDP and Government of Mauritania | 107 |
| 5. Role and Responsibilities of UNDP Country Office                  | 112 |

## ABBREVIATIONS

|          |   |
|----------|---|
| AFVP     | Association Française des volontaires du progrès  |
| BTI      | Technical Intervention Bureau (Bureau technique d'intervention)                                 |
| CF       | Coopération Française   |
| CFD      | Caisse Française de développement   |
| CNEA     | National Centre for Alternative Energy  |
| CSET     | Centre supérieur d'enseignement technique   |
| DE       | Department of Energy (Direction l'énergie)  |
| DH       | Department of Water (Direction de l'hydraulique)  |
| EER      | Espace eolien régional  |
| EU       | European Union  |
| GRET     | Groupe de recherche et d'échanges technologiques  |
| GTZ      | German Technical Cooperation Agency   |
| Hp       | Horsepower  |
| ICB      | International call for bids   |
| IDM      | Investissement-développement en Mauritanie  |
| kW       | Kilowatt  |
| NGO      | Non-governmental organization   |
| OECD     | Organization for Economic Cooperation and Development   |
| OPS      | Office for Project Services   |
| PV       | Photovoltaic  |
| RSP      | Regional Solar Programme  |
| SIDI     | Société d'investissement de développement international   |
| SOMEQUIP | Mauritanian Equipment Company (Société Mauritanienne pour les équipements)                      |
| SOMER    | Mauritanian Company of Regenerative Energies (Société Mauritanienne des énergies régénératives) |
| STEC     | Scientific and Technical Expert Committee   |
| WHO      | World Health Organization   |

# UNITED NATIONS DEVELOPMENT PROGRAMME

## GLOBAL ENVIRONMENT FACILITY

Project of the Government of the Islamic Republic of Mauritania

|  |   |
|--|---|
| <b>Title:</b>                          | Decentralized Wind Electric Power for Social and Economic Development (Alizés-électrique)                             |
| <b>Number:</b>                         | MAU/93/G31  |
| <b>Duration:</b>                       | Five years  |
| <b>Project Site:</b>                   | Trarza region, Banc d'Arguin National Park, Adrar   |
| <b>UNDP Sector:</b>                    | Environment   |
| <b>Government Implementing Agency:</b> | Government of Mauritania, Ministry of Water and Energy  |
| <b>Executing Agency:</b>               | Department of Energy (DE)   |
| <b>Support Agency:</b>                 | UNDP Country Office   |
| <b>Associated Agency:</b>              | Groupe de recherche et d'échanges technologiques (GRET)<br>(Executing agency under contract with UNDP Country Office) |
| <b>UNDP Approval:</b>                  | June 1994   |
| <b>Estimated Starting Date:</b>        | October 1994  |
| <b>Government Inputs:</b>              | Ouguiyas (UM) 8,894,621 (US\$ 73,552) (in kind) <sup>1</sup>  |
| <b>GEF/UNDP Inputs:</b>                | US\$ 2 million  |
| <b>Brief Description:</b>              |   |

The project will work to establish a replicable, widely-used mechanism for sustainable diffusion and support of small-scale decentralized wind electric power generation units. These units will

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<sup>1</sup> The official United Nations exchange rate of US\$ 1 = 120.93 UM has been used for conversions in this document.



function as a form of pre-electrification to support investments in social and economic development in rural and semi-rural Mauritania. The approach of the project includes:

- Determination of the needs, markets, and opportunities for the use of small-scale wind electric technologies in the rural sector
- Establishment of technical, financial, and institutional mechanisms for private sector-based introduction and sustainable diffusion of these technologies
- Implementation of an effective programme of wind electric applications.

An associated objective is to share the project experience with decision-makers, investors, and the private sector in other developing countries, especially in Africa and Asia, and with the international development community. The project described in this Project Document is the initial GEF/UNDP funded phase of a five-year technical assistance project approved by the GEF in Abidjan (December 1992).

## A. CONTEXT

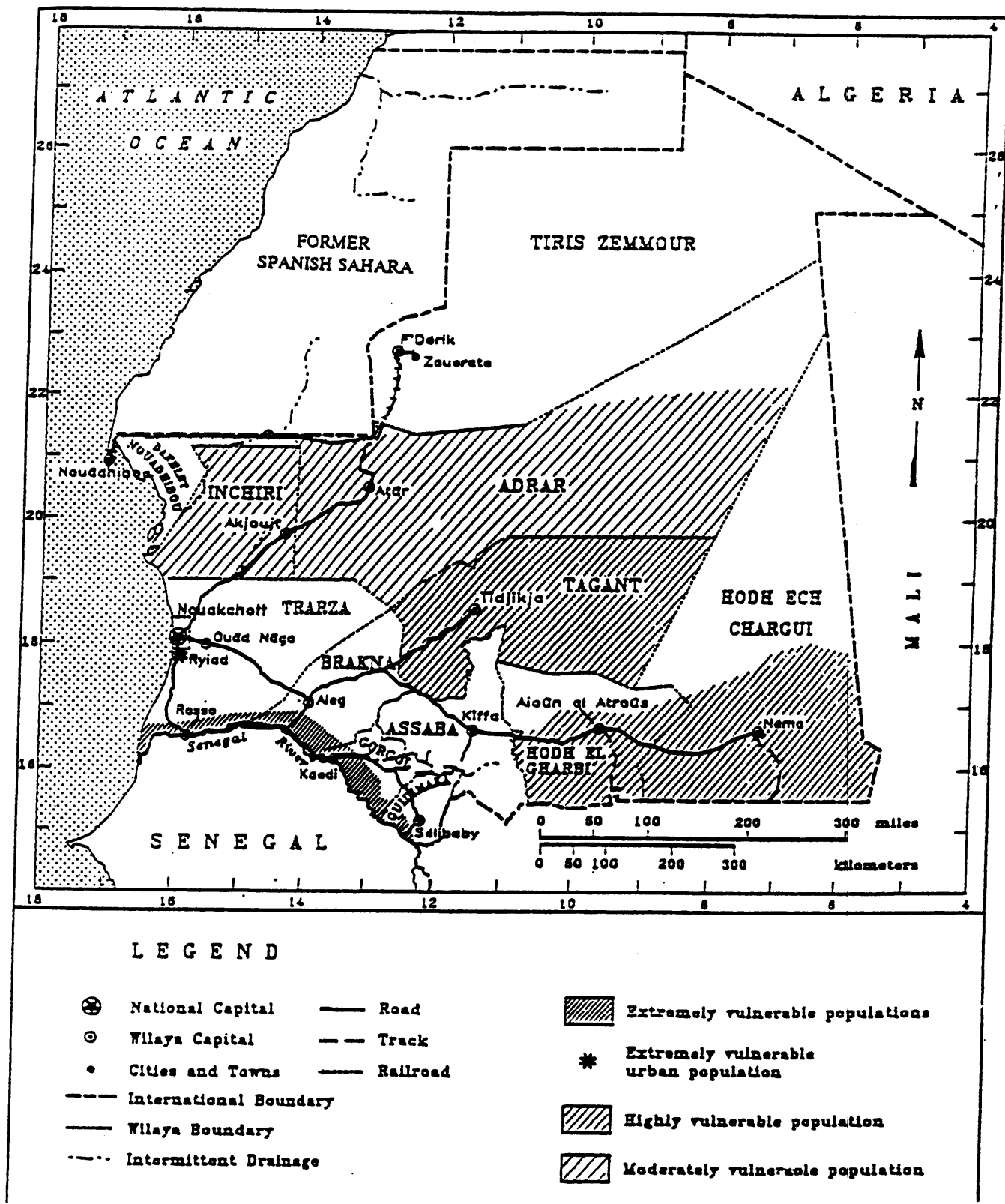
### The economic and demographic situation in Mauritania

Mauritania is a West African country bounded to the North by West Sahara and Algeria, on the East and Southeast by Mali, on the South by Senegal, and on the West by the Atlantic ocean (see Figure 1). The land area is slightly over 1 million square kilometres (km<sup>2</sup>) in area, but with only 2 million inhabitants. Two-thirds of the land is desert; the southern region is Sahelian. Only in the flood plain of the Senegal river, the border between the two countries, is there abundant water and rich soil suitable for intensive cultivation. Ten percent of the population lives in the desert; the majority lives on just 15 percent of the land, primarily in the Sahelian, coastal, and Senegal River regions.

Mauritania has a total population of 2 million inhabitants. Its population density is 1.8/km<sup>2</sup> and its growth rate is 2.8 percent per year. The population is very young, with more than half under the age of twenty. It is also very diverse, consisting of Arabo-Berbers (Moors) and Sudanese (Toucouleur, Fulah, Wolof and Soninke). The nomads accounted for 70 percent of the total population in 1965, but only 12 percent in 1988.

Ninety percent of the Mauritians live below the 18th parallel, along the two main settlement axes: the so-called "path of hope," and the Senegal River Valley. Rural zones with no access to the coast and lacking in basic socio-sanitary installations are sources of emigration and add to the slum population whose growth rate is approximately 37 percent per year. Women account for 50.5 percent of the population; 33 percent of them are heads of households and 62 percent are illiterate. There are 13 percent women on payroll within the State administration. As a result of the trend toward sedentariness, women's groups have developed (there are 500 cooperatives with 21,000 women members) to organize income generating activities such as horticulture or decorative and practical crafts.

Figure 1 - Mauritania



In the early 1970s, Mauritania appeared to possess the qualities required for sustainable development. Farming in the centre of the country, despite low rainfall, and irrigated crops along the river (within the multinational framework provided by the Organization for the Improvement of the Senegal River (Organization pour la mise en valeur du fleuve Sénégal (OMVS)) justified hopes of a marked increase in food production. The two main non-agricultural resources in the country, iron ore extraction and commercial fishing (currently bringing in 55 percent of export income), ensured the equilibrium of the trade balance. The industrial sector was barely developed, while the informal artisan sector enjoyed relative prosperity.

During the 1970s, Mauritania went through a period of stagnation marked by severe financial imbalances and socioeconomic upheaval. Among the responsible factors were the recurrent droughts, the impact of the worldwide economic crisis, the dropping price of iron, non-productive public investments (such as oil refineries, sugar mills and flour mills), massive borrowing, and destabilization of the banking system.

While high quality fuels and electricity are required to improve the quality of life in the rural environment, Mauritania has only three indigenous sources of energy: fuelwood and charcoal, which increasingly are being used in a non-sustainable manner; solar; and wind energy. All petroleum is imported, and in rural areas the price<sup>2</sup> of kerosene is about US\$ 100/bbl.

In 1985, the government decided to implement a structural adjustment policy. Several successive programs were initiated: the Economic and Financial Recovery Programme (1985-88), and the Consolidation and Rehabilitation Programme (PCR 89-91).

A major problem for the country is the very rapid growth in the urban population (approximately 20 percent per year), notably in Nouakchott, as a result of rural migration. In the absence of basic amenities in the rural environment, this trend is likely to continue. The carrying capacity of Nouakchott is severely challenged. Many immigrants to the city are unable to find employment, and living conditions in the shanty towns ringing Nouakchott are in many ways worse than the rural environments the new residents have left behind.

## **1. Description of subsector**

The subsector (or "sector" in government terminology) of concern in the Alizés-électrique project is the rural development sector, not the energy sector. The project objective is to provide services for social development (drinking water, electricity for health stations, public lighting, mosques, and other uses) and economic development (ice making, refrigeration for fishing villages, small-scale irrigation, lighting for stores and workshops, refrigeration of freshly drawn milk, and so on). Energy is therefore an underlying theme for sustainable rural development, but not an objective *per se*.

There is no established rural electrification subsector in Mauritania, and the government presently has no programme for rural electrification. Only the capital and main urban centres are

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<sup>2</sup> All cost figures are shown in 1992 U.S. dollars.

electrified. The only sources of electricity in small communities are privately-owned small generator units, auto batteries, and dry cells. Within the framework of the European Union (EU) Regional Solar Programme for West Africa, some fifteen photovoltaic (PV)-powered lighting and refrigeration systems have been installed with support from the Economic Development Fund of the EU, together with as many PV-powered pumps. Several wind generators have been installed in rural villages by Groupe de recherche et d'échanges technologiques (GRET) within the last twelve months.

In the structure of the United Nations Development Programme (UNDP) Rural Development Programme, there is practically no discussion of the crucial importance of the use of electricity in the rural economy and social development, especially in agriculture.

In the government's Consolidation and Rehabilitation Programme (1989-91), one of the objectives for renewable energy is water pumping. Under the "Subsector alternative energy" heading, the programme specifies that:

During the 1989-91 period, the application of alternative energy sources must conform to strict criteria in terms of cost advantages. However, the development of these alternatives is linked to assigning permanent managerial personnel to the Department of Energy (DE), thus allowing it to implement its programmes normally, without disruptions.

The rural sector is dominated by animal raising. According to government figures for 1991, the agro-pastoral sector in Mauritania represented the principal activities of two-thirds of the population and accounted for 19 percent of the GDP (fisheries not included). For 1989 and 1990, the mean GDP value had been evaluated at UM 222 billion for the "rural sector" (crops and animal products). Recently, the sector has experienced very rapid changes caused mainly by a degradation of climate conditions which resulted in population shifts and an increase in rural communities (2,345 in 1977 to 3,553 in 1987). The population addressed by the project is about 1 to 1.5 million, more than half the total population.

## **2. Host country strategy**

An integrated rural development strategy has not yet been designed by the government, although some activities that could support such a strategy are either in place or being developed. To improve the conditions of rural life, the government has developed programmes, often in conjunction with international agencies and non-governmental organizations (NGOs), to address issues of water supply, health, food production, and nutrition, as well as to support small enterprises. The government continues to depend on external donor assistance, primarily from the United Nations (UNDP, UNICEF, and the World Health Organization (WHO)) and European bilateral donors (primarily France, Germany, and the EU).

The national electric utility company (SONELEC) is focusing all its efforts and limited resources on providing reliable electricity to Nouakchott, Nouadibhou and Rosso. With the exception of one hydroelectric facility under construction on the Senegal River, no rural electrification plans exist for SONELEC or any government agency for the coming five years or more. Electrification of the peripheral zone of Nouakchott is also not planned.

As regards the supply of electricity in rural areas, the willingness and ability of the population to pay for the service is not clearly known and will be one of the first areas to be explored within the project. Based on the experience acquired within Project Alizés, it would appear that numerous communities wish to have electric equipment, and are able to finance at least a substantial portion of the capital costs, as well as all of the operating costs.

### Government strategy for rural development

The policy pursued by the government for rural development focuses on three principle objectives:

- *Food security.* This must be enhanced through better management of the staple food channels, increased production, extended irrigated surface areas with partial or total water control, subsistence crops, and other methods.
- *Rural water management.* This comprises village, pastoral and agricultural projects. It should take into account to a greater extent the necessary rangeland management within the framework of improved cultural/animal husbandry.
- *Environment.* Environmental conservation and improvement.

For the period 1992-94, the rural development strategy has been applied in three areas:

- Increasing the production potential through better knowledge of this potential (for example, animal husbandry and water projects), better land management (land-use planning), better exploitation (intensified agricultural practices, streamlined animal raising), better overall management, and a financial contribution from the population
- Enhancing the support for the sector by means of an effective rural credit policy, improved extension services, research, training, institution building, and efforts towards price and trade liberalization
- Farm optimization by designing cheaper irrigation systems, increasing the size of public irrigated farms, improving management activities, and granting land tenure to farmers.

### Energy sector strategic goals

In the area of energy, the government approved a sectoral development strategy in 1987. This strategy aims at balanced development of the sector, and at achieving the following objectives:

- Ensuring and enhancing the security of energy supplies over the national territory
- Maximizing the use of clean energy resources
- Controlling operating and supply costs.

A development plan for electrification of secondary population centres is being prepared.

These centres will be equipped with thermal power plants installed by the National Mining Company (SNIM). Some centres may also be supplied by a direct connection to the high-voltage line from Manantali (hydroelectric plant in Mali), initially following the Senegal River course and then branching off towards Nouakchott at Rosso. There are no provisions being made for supplying electricity to rural areas.

#### *Water policies*

The main objectives of the government in this area are:

- Meeting the needs of the total population and of the cattle
- Preserving water quality
- Using natural grazing areas through rational creation of water points
- Total assumption of water supply costs by users
- Ensuring water control in order to enhance the economic potential of the country
- Rational use of water resources
- Promoting private sector activities in the rural water subsector.

The development of water points, user fees, and private sector activities are of particular importance.

#### Priorities of the Ministry of Health and Social Affairs

The priorities of the Ministry of Health and Social Affairs relevant to the project are:

- Gradual extension of immunization coverage to 75 percent of the child population
- Improving the availability of, and access to, essential medicines for as many people as possible at affordable, controlled prices
- Enhancement of health training capacities
- Extending health care coverage to the entire population
- Increasing social mobilization
- Reinforcing the organization and management capacities at the ministry level, and implementing decentralization
- Developing and implementing a strategy allowing for contribution of the population to the financing of public health care services
- Developing the National Health Information Service
- Improving human resources management.

Two points are of particular interest for the project: developing the immunization coverage, and the will to implement a cost recovery policy.

#### Distribution of electric power produced by the Manantali hydroelectric plant

OMVS Resolution 20 (dated August 20, 1992) states the need to supply power to each of the three OMVS states by means of a high-voltage line. Such a line will therefore be built in Mauritania along the Senegal River. In Matam-Civé, Kaédi, and Boghé, the high-voltage line will be improved, and in Dagana, Djédar El Mohghen, and Nouakchott, a 225 kVA line (used at 90 kVA) will be constructed.

A high-voltage line will cross the Trarza pilot area, starting some 10 kilometres east of Rosso, and passing onward to Nouakchott. Only major centres will be supplied, however, which still calls for the creation of decentralized electric power supplies in the region, in view of the fact that the cost of supplying electricity to small villages from these high-voltage transmission lines would be prohibitively expensive for the limited quantity of electricity used.

### **3. Prior and ongoing assistance**

There are four major international technical assistance projects underway in Mauritania. All four of these projects are in the energy subsector: butane gas supply, the European Union-sponsored West Africa regional PV water pumping project (Regional Solar Programme (RSP)), production and dissemination of improved residential cook stoves, and Project Alizés. Two of these projects, Project Alizés and the PV water pumping programme of the European Union, are concerned with the use of wind and solar energy resources for decentralized applications.

#### Main programmes of the Department of Energy

##### *National Butane Gas Programme*

This programme is part of the Sahelian Regional Butane Gas Programme financed by the EU (5th Economic Development Fund) for the replacement of fuelwood by butane gas in urban centres in order to relieve the pressure on forest resources in each of the nine Sahelian countries.

In Mauritania, this programme has resulted in:

- Very low-priced gas containers (3-kilogram bottle and 6-kilogram bottle with burners) in order to involve a large number of low- and middle-income households
- Local production of improved residential cook stoves through training and follow-up with local craftsmen
- Launching of public awareness, promotion, and education activities for the efficient use of butane gas.

### *Regional Solar Programme for the Sahel (RSP)*

This programme, financed by the European Union, is supporting the installation of 1,000 solar-electric water pumps in the Sahel region. The objective is the large-scale introduction of PV water pumping equipment in rural areas. Achieving this goal will contribute to increased autonomy of the pumping equipment, and improve the standard of living of the population through the initial stages of electrification.

The programme provides for the supply of 108 solar pumps and 44 community refrigeration and lighting units in Mauritania. Concurrent with the provision of equipment, the RSP aims specifically at developing and implementing local maintenance capabilities, a more realistic cost-recovery policy, and allowing the village committees to control the equipment.

### *Improved stove distribution programme*

This programme, initially funded by UNSO, UNIFEM and the Government of Mauritania, is being implemented jointly by the Departments of Energy and the Environment. The programme has been financed by the World Bank since 1992. Its objectives are:

- To establish the basic structures and train the personnel to be involved in the programme's activities
- To train metal craftsmen for the design, tracing, and implementation of the technical norms for improved efficiency stoves
- To market the improved efficiency stoves in the city of Nouakchott and several other urban centres
- To contribute to the development of substitutes for wood and charcoal.

The long-term goals of the programme are to alleviate pressures on natural forest resources, and improve the living conditions of the population. This programme has been underway since 1987, with good results in Nouakchott, as well as in regional capital cities and towns including Rosso, Kiffa, Kaédi, Sélibaly, Néma and Boghé.

### *Project Alizés for wind mechanical water pumping in southern Trarza*

An important model for diffusion of small-scale energy systems for rural development is Project Alizés. This project is the basis for the proposed UNDP project, which has become known as Project Alizés-électrique. The goal is to establish local private sector capacity to support the sustainable use of small-scale wind electric power generation systems to help support rural social and economic development.

Project Alizés is a cooperative project of GRET, a French NGO, and the Government of Mauritania, Department of Energy, initiated in 1990. Over the past two years, in collaboration with the local private sector, Project Alizés has implemented an effective programme to bring wind



mechanical water pumping technology to Mauritanian villages, and with it, reliable supplies of potable water.

To support the indigenization of all technical capabilities, including manufacturing, assembly, installation and maintenance, Project Alizés arranged an extensive collaboration and technology transfer between the small Mauritanian company Deyloul, and the French company Poncelet, which is a leading producer of wind mechanical water pumps marketed under the brand name "OASIS." Deyloul is presently the only producer of wind mechanical water pumps in Mauritania. The significant benefits of this transfer of technology are:

- The local availability of high-quality units at a significantly lower price (approximately 30 percent) than if purchased abroad
- Elimination of foreign exchange requirements
- Elimination of difficulties (such as special permission from government) in importing machinery into the country
- In-country support of operation and maintenance under warranty, something not practical with foreign-purchased mechanical equipment.

Project Alizés works closely with Mauritanian villages to assess the possibilities for wind-based mechanical water pumping, to install systems for water pumping, filtration and purification (if necessary), and for water storage and distribution. The integral element of the project is provision of ongoing maintenance and technical support through the private sector. A local company, Deyloul, produces most of the hardware, and several employees have been trained to build covered water storage tanks. Project Alizés catalyzed and actively supported the entry of Deyloul into this business. Under this project (Alizés-électrique), Deyloul and other local companies will receive similar support to enter the wind electric technology business, in collaboration with international suppliers.

During the initial two years of the project, forty-nine installations have been made in the southwestern region of Trarza, in Méderdra, Rosso, R'Kiz and Keur-Macène. The units are functioning well because the technology selected is simple and rugged, and because there is a regional service network established by Project Alizés and Deyloul that responds quickly when there are mishaps and occasional breakdowns. Installation of an additional fifty units is projected through mid-1995.

During the initial demonstration phase of one hundred installations, the villages are required to make an initial payment of about 15 percent of the capital costs, and also pay for an annual full support contract. The units are guaranteed for six months; after that the villages are responsible for the maintenance of the wind pumps through a maintenance contract with a local company specializing in wind mechanical units. After the initial demonstration phase, villages will have to pay for the majority of the capital costs of the wells and wind pump/storage system. (Six such systems have already been sold to private individuals on a full-cost cash basis.)

Project Alizés is supported by the EU, the Cooperation Française, and by French NGOs. The objectives of Project Alizés are:

- Supplying and maintaining 100 wind pumps for water pumping, with local community financial participation
- Establishing a local plant (along with supervisory personnel) to manufacture the wind pumps
- Training regional repair personnel to maintain the wind pumps.

The institutional arrangements for Project Alizés are as follows: the Department of Energy is the executing agency, and GRET the implementing organization. A steering committee representing the Departments of Energy and Water Resources meets at least twice a year. Project Alizés is an example of successful collaboration between two NGOs (GRET and EER) and two Government of Mauritania ministries. The NGO directly mobilized the necessary financing while the public administration provides important assistance on two aspects: scientific monitoring of the project (Department of Energy), and more importantly, drilling of the wells (providing equipment, vehicles, building devices and personnel).

#### **4. Institutional framework for subsector**

##### **Overview**

The Ministry of Water Resources and Energy consists of two departments: the Department of Water Resources (Direction de l'hydraulique—DH) and the Department of Energy (Direction de l'énergie—DE).<sup>3</sup> The DH is responsible for:

- Establishing the national water policy
- Exploration and extraction of water, in particular geophysics and hydro-geological studies
- Village-level water projects (for example, wells, boreholes and sources)
- Urban water projects (production, infrastructure, drinking water supply, cleaning stations and sanitation networks)

The Department of Energy is responsible for establishing the national strategy for energy sector development. This development is achieved through statistical and forecasting studies of energy demand, and by planning the needs according to the sector and the type of energy (fuelwood, charcoal, fossil fuels, electricity, renewable energy, and so on). The Department of Energy is also responsible for:

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<sup>3</sup> Source: Decree 6186 of July 2, 1986.

- Refining, storage, transportation, and distribution of hydrocarbons
- Promotion of alternative energy sources
- Regulation of controlled institutions
- Formulation of legislative and regulatory draft texts regarding the use of the various energy sources
- Control of the enforcement of applicable laws and regulations in the area of energy.

In addition to these responsibilities, the Ministry of Water Resources and Energy is in charge of coordinating and monitoring all issues related to the OMVS. It also has trusteeship and control powers, as defined by the applicable laws and regulations, over the following public companies:

- The National Water and Electricity Company (SONELEC)
- The Mauritanian Association of Refinery Industries (SOMIR)
- The National Centre for Alternative Energy (CNEA)
- The Mauritanian Company for the Marketing of Petroleum Products (SMCPP).

The Department of Energy is therefore in charge of all issues related to energy in the country. Its primary activity is fuel management, principally the importation and distribution of petroleum products.

The generation and distribution of electricity is provided by SONELEC, a public electric utility company placed under the supervision of the Department of Energy. SONELEC is the only company officially authorized to distribute electricity. In major cities already electrified, SONELEC ensures the generation, distribution, and sale of electricity. Within the programme aimed at supplying power to secondary urban centres, however, SONELEC entered into an agreement with SNIM, the large national iron ore mining company in the northern part of the country, whereby SNIM installs and maintains the power generation plants, while SONELEC only manages the sales of electricity.

The Department of Energy is also responsible for managing national energy resources. In particular, it designed the major programme for substituting butane gas for fuelwood described below.

There have been few experiments in Mauritania in the wind energy sector. Worth mentioning are a few past experiments of limited scope with multi-blade turbines (one large diameter turbine, Sahore wind turbines, and small mechanical multi-blade turbines), and the ongoing Project Alizés described below.

There has never been a systematic programme for wind energy resource measurement and documentation in Mauritania. In 1987, the Italian bilateral development cooperation agency installed

five wind measuring stations in the country. Raw data were collected, recorded, and analyzed by computer. However, this programme was unsuccessful due to a lack of funds to finance the travel of the Department of Energy team responsible for data collection. There are data for wind resources in several Mauritanian towns, but their reliability is not established. A wind resource study has been conducted, and its results constitute the only existing reference. The study is part of a thesis research effort, based primarily on computed data. The study indicates that wind energy resources in Mauritania are substantial, but measurements are required to quantify the wind resource.

### NGOs in Mauritania

Of the approximately thirty NGOs operating in Mauritania, most are international; about half have permanent offices in the country. Despite a recent effort to establish local NGOs, Mauritanian NGOs are rare. Besides the NGOs, there are a large number of partnerships between Mauritanian towns and villages, and local French communities within the framework of decentralized cooperation.

**Table 1**

#### **NGOs belonging to the federation of NGOs in Mauritania**

Africa 70  
Lumière vie et amour  
Association Française des volontaires du progrès (AFVP)  
Oxfam  
Caritas  
Pharmaciens sans frontières  
Communauté Doulos  
Terre des hommes Lausanne  
Fédération Luthérienne mondiale  
World Vision International

**Table 2**

#### **Other NGOs active in Mauritania**

Ligue Islamique mondiale  
Terre des hommes France  
Organization internationale Islamique de secours en Mauritanie  
Groupe de recherche et de développement rural (GRDR)  
SIDI (IDM)  
Médecins sans frontières  
Médecins du monde  
Peace Corps (United States)  
Seeds of Survival (SOS) Sahel  
GRET (France)

Citées unies  
 Adour Pyrénées Sahel  
 Equilibre  
 Enda  
 Les amis de Raoul Folleraux  
 Terre vivante  
 Union des handicapés physiques et mentaux de Mauritanie groupe d'intervention des anciens du corps médical  
 Assemblée du "Complexe Cheikh Malainini"  
 Association de la protection de la nature  
 Institut de bienfaisance et d'aide aux plus démunis  
 Corps de bienfaisance des Emirats Arabes Unis  
 War on Want

Private sector entities in the renewable energy area<sup>4</sup>

There is no private company in Mauritania with experience in the installation, operation, and maintenance of wind generators. Four companies have entered, or have expressed a desire to enter, the area of renewable energy.

- *Technical Intervention Bureau (Bureau technique d'intervention—BTI).* The BTI was created in 1985 as a national unit specializing in the production, installation, and maintenance of medical and solar-power equipment. It manufactures solar lamps, regulators, and mosque amplifiers at low cost, locally in Nouakchott. BTI has a staff of fourteen. It is also active within the RSP in Mauritania to perform equipment installation and maintenance.
- *Mauritanian Regenerative Energy Company (Société Mauritanienne des énergies régénératives—SOMER).* SOMER was created in May 1991, and has a staff of thirty-one. The company claims to specialize in the manufacture of solar- and wind-powered equipment (such as inverters, regulators, water-heaters and wind generators). Supply of these products is in the planning stages.
- *Deyloul Company.* Established in 1990, Deyloul specializes in the manufacture, installation, and maintenance of wind-powered mechanical pumps. Thanks to technical guidance provided within Project Alizés, Deyloul now has the technological know-how required to manufacture OASIS brand windmills that are 2.5 and 3.5 metres in diameter. Project Alizés facilitated this technology transfer between Deyloul and the French company Poncelet. One of the principal results of the technology transfer is the local availability of quality windmills at significantly lower cost (30 percent), than those available from abroad. These windmills are

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<sup>4</sup> The information provided here was given by the companies themselves. The figures quoted could not be checked, with the exception of Deyloul.

manufactured in Nouakchott in a workshop employing ten people. The operation, maintenance, and repair can all be done locally, without recourse to international companies.

- *Mauritanian Equipment Company (Société Mauritanienne pour les Equipements - SOMEQUIP).* The SOMEQUIP Company is involved in the distribution of petroleum products (transportation and sales). It is considering entering the area of renewable energy, and maintains relations with LMW (a Dutch manufacturer of small wind electric turbines) for purposes of representation in the wind-generator and solar energy areas.

## **B. PROJECT JUSTIFICATION**

### **1. Problem to be addressed and the present situation**

The use of renewable energy technologies for small-scale electric power generation is just beginning in Mauritania. The European Fund for Development of the EU is financing a programme for the installation of PV pumps in several areas of the country, within the framework of a US\$ 40 million programme for PV pumping in West Africa. Where the wind resources are reasonably satisfactory (monthly mean wind speed above 4 metres/second), wind turbines can provide a more economical method for decentralized supply of electricity generated from renewable energy sources.

Mauritania is one of the windiest countries in West Africa, with average wind speeds ranging from 4 to over 8 metres/second over much of the country. Wind data, although sketchy, indicates that wind generation systems, from a few hundred watts to several kilowatts (kW), may be more economical over their life cycle than petroleum, gasoline, or diesel fuel units.

Decentralized provision of electricity will not in itself spur development. Decentralized electric installations, whether fossil fuel-based or renewable energy-based, must be developed in concert with activities that address specific social and economic development needs. Fortunately there are many such suitable activities in both the private and public sector, many with bilateral and multilateral support. They address rural development needs, and require small amounts of reliable electricity. These activities include the organized development of village water supplies, both with PV and wind mechanical pumping systems, support of dispensaries and pharmacies (CARITAS), support for health services including child immunization (UNICEF), refrigeration of food stuffs, especially cash crops and fish, and development of a modern dairy industry with milk from camels and indigenous cattle (Laitière de Mauritanie).

The majority of the rural population lacks the basic elements to provide even a minimally satisfactory quality of life. Due to insufficient hygiene and the lack of safe access to drinking water and health care, there is a high rate of chronic infections and diseases, resulting in a very high infant mortality rate (132 per 1,000), a troubling global morbidity rate, and an average life expectancy only two-thirds that of countries belonging to the Organization for Economic Cooperation and Development (OECD). The literacy rate is low (34 percent for men), and the opportunities for income generating activities limited.

The lack of electric power in most parts of the country is a major obstacle to improvement in these areas. Electricity is a key input to address these issues (although obviously not the only input necessary). The specific needs of the rural population as regards electricity supply include:

- Household lighting, radio and television
- Water pumping (including deep pumping beyond 30 metres)
- Water treatment
- Surface pumping for irrigation
- Battery charging
- Refrigeration
- Miscellaneous (electric fencing and other needs)
- Community needs such as health stations, schools, mosques, shops, workshops and public lighting.

All these activities require reliable, affordable, decentralized sources of electricity. For example, for wells more than approximately thirty metres in depth, electric pumping is required because mechanical pumping is not practical. A significant part of the population lives in regions where water is available, but only at depths below the reach of wind mechanical pumps. These and other activities described in this document indicate a significant opportunity for the widespread and economic use of small-scale wind electric power in Mauritania.

Until recently there were virtually no modern small wind electric units operating in Mauritania. The introduction of wind electric technology to provide an expanded set of important services to village communities is a natural and appropriate next step in the work of Project Alizés, which recently (June 1993) completed six wind electric installations as an initial intervention in this area.

Wind electric water pumping in regions where the water table is too deep (30-80 metres) for mechanical pumping will permit direct extension of this project into regions where wind mechanical pumping technology cannot be used. Expansion of the project will also permit supply of electricity for other needs. Wind electric pumping can also provide pumped irrigation at costs less than or competitive with diesel pumps, and with greater reliability. Project Alizés has received several requests for wind electric pumpsets from villages with relatively deep groundwater, and is increasingly receiving requests for wind electric turbines from villages where mechanical wind pumps have been installed.

Even prior to the start of the current project, the Project Alizés team has gained experience with a few wind electric installations. One of these installations is a 1 kWe wind electric system for ice making, lighting, and battery charging in a village, carried out in cooperation with SIDI. The second is a wind electric water pumping, cleanup, and distribution system in the village of Keur Macène, in collaboration with Programme Melun-Senart/Trarza (see below), and with financial assistance from the Programme Melun-Senart/Trarza, the Coopération Française, UNICEF, the government, and the EU. A third installation concerns the distribution of electricity to some fifteen shopkeepers in Tighent. Three other small wind turbines provide lighting and supply a health clinic.

## The role of electricity in rural social and economic development

Some two billion people, mostly in the rural regions of the developing countries, are presently living without electricity. Traditional programmes of rural electrification, through power line extensions and stand-alone diesel power generation, have proven to be very costly and often financially unsustainable. A joint United States Agency for International Development (USAID)/World Bank retrospective study (1990) of two decades of lending for rural electrification revealed both the poor economic and financial rates of return of many such projects, and the technical difficulties of maintaining diesel generators in rural environments.

Many key social and economic development services for rural populations require electricity. In Mauritania, as in other developing countries, rural populations are pressing the central government to provide electricity services. Without electricity, significant economic and social development is virtually impossible. Targeted use of small quantities of reliable electricity in conjunction with programmes of economic and social development can make a significant difference in the conditions of rural life.

Over the coming several decades, it is expected that some degree of electrification will be brought to a significant fraction of the world's rural population. If present trends continue, virtually all of this electrification will be provided by fossil fuel combustion, decentralized diesel and kerosene engines, and line extension from electricity grids containing a significant component of fossil-fired generation.

## Global impacts of renewable energy systems for rural power delivery

New and effective models for serving the primary needs of rural populations through local electric power delivery in an environmentally sustainable manner need to be developed and widely replicated. Use of solar electric, wind mechanical/electric, biomass-based, and other renewable energy systems will avoid or minimize growth in carbon dioxide emissions associated with the expansion of rural electric power services. Widespread use of such systems, coupled with indigenization of the assembly and eventual production of equipment, can ease the pressure on foreign exchange reserves, reduce the requirements for fuel imports, and therefore contribute to the national economy. *Moreover, in countries such as Mauritania, with extensive regions that are extremely windy, the average cost of production of electricity from wind turbines is well below the cost of electricity from PV and small-scale engine generators, which are the only other practical options.*

In the developing world, few examples exist of a well-functioning private sector-based infrastructure for dissemination, training, maintenance, and support of dispersed renewable energy-based electricity services for social and economic development. The recent phenomenon of commercial diffusion of PV home lighting units in countries such as Sri Lanka, Kenya, Zimbabwe, and the Dominican Republic is important, but the application is in the form of single residential units purchased for a limited purpose (lights, radio and television). These units rarely provide power for important economic activities or social development. An important innovation is the EU PV Water Pumping Programme for the Sahel, which provides an example similar to Project Alizés, in which communities pay a fraction (approximately 25 percent) of the installation and cost, and the ongoing operation and maintenance costs of the units.



## **2. Expected end-of-project situation**

This section refers to the end of Phase 1, or Project Alizés/électrique (Alizés/é), for which this document has been prepared. It is expected that at the end of the initial phase of the project the following will have been accomplished:

- A local private sector capacity will have been established for assembly, installation, maintenance, and repair of small wind electric power units and associated end-use equipment
- A survey and analysis of the needs for decentralized small-scale electricity and the associated markets for small-scale wind electric systems in Mauritania will be completed and published
- A preliminary wind energy database will have been developed through a measurement programme based at the Department of Energy, and a preliminary national wind energy atlas will have been published
- Selection, procurement, installation, testing, and technical and economic evaluation of a variety of wind electric-powered systems for water pumping, battery charging, refrigeration, ice making, lighting, and other uses, including forty very small units (rated power under 100 We) and fifteen larger (0.5 to 2 kWe or greater) systems will be completed for the Phase 1 pilot region, with the results presented in project reports
- Several pilot co-investments in both social development and economic activities will have been made and the results assessed
- For the pilot region, a survey and analysis of the socioeconomic, sociocultural, and environmental impacts of the installed wind electric systems will have been conducted and published
- Several engineers and others attached to the Department of Energy will have developed technical, analytical, and project management skills that can be used to support subsequent phases of the project, and to design and implement new projects for pre-electrification and development
- Through the local news media and publications and presentations by the project team, the government, UNDP, donor organizations, NGOs, the private sector, and the general public will have been well informed about the opportunities and experiences with small wind electric systems
- Suitable policies regarding tariffs, financing rural electric power delivery, and other aspects of establishing a sustainable wind electric power industry in Mauritania will have been identified by the project team in collaboration with the government

- Financing for Phase 2 will have been developed and put in place prior to the end of Phase 1.

### 3. Target beneficiaries

The target beneficiaries of the project include: rural communities, cooperatives, and enterprises that benefit from the availability of reliable decentralized small-scale electricity supply; the local private sector involved in equipment assembly, installation, and maintenance; and government and development assistance agencies which can provide decentralized electric power-based services.

### 4. Project strategy and institutional arrangements

#### Project strategy

The initial project strategy builds directly on the design, methods, and experience of Project Alizés, hence the name of the project, Alizés/électrique.

#### *Strategic operations*

The strategy begins with a survey and analysis of the needs for decentralized small-scale electricity, and the associated markets for small-scale wind electric systems in Mauritania. The Department of Energy, in conjunction with the University of Mauritania and with assistance from project staff, will develop a preliminary wind energy database, and a preliminary national wind energy atlas will be published. As part of the capacity-building element of the project, two Department of Energy engineers will participate fully in the project, one on a full-time basis within the Department of Energy framework for such tasks as may be assigned to him or her, and the other to be seconded to the GRET team as the project Technical Director.

In parallel, the leading international suppliers of small-scale wind electric equipment and related end-use applications will be contacted, and their products, technical and economic characteristics, and corporate capabilities will be identified. This process will lead to the procurement, test, and field installation of wind electric systems.

Equipment installation will be based on the principles below. The project will begin by reviewing the situation and needs of the villages as well as the wishes of the population. The equipment required to meet the needs and specific sites can then be identified. The following principles are key to equipment installation:

- The beneficiaries must show interest in the project, and a desire and ability to contribute to the purchase and maintenance costs (both in cash and kind)
- Private sector involvement in order to establish local supply and service
- Mobilization of funds with up to 100 percent cost recovery in some cases

- Geographical concentration of the equipment (and ease of access for Phase 1) in order to facilitate maintenance, community development, and evaluation
- Final selection of suitable sites, after financial contribution (in kind as needed) by the beneficiaries
- Information and discussions with the target groups, in order to study the interest for, and methods of, management of the wind power equipment
- Establishment of complete local services facilities for the wind turbines and end-use accessories in order to provide the beneficiaries with equipment in good working order at installation, and to assure efficient operation through ongoing contracted maintenance
- Research on economic or social applications in order to create income-generating activities in connection with the provision of decentralized electric power
- Use of other energy sources as needed to maximize the value of wind energy (in Phase 2, this approach will be more systematically implemented)
- Developing funding independently of project sources in order to ensure durable funding capabilities in the post-project phase.

A local private sector capacity will be established by developing interest in the private sector through technical demonstrations, establishment of lines of credit, and direct technical assistance, and facilitation of collaborative arrangements with foreign suppliers of equipment and services. These activities will be based on the successful experience of Project Alizés in catalyzing the establishment of local suppliers and maintenance organizations for wind mechanical water pumping equipment.

The project team will collaborate with the government on the design of appropriate energy policies to establish favorable conditions for the sustainable development of wind and other renewable energy technologies in Mauritania. The project strategy will also work to maximize the impact of its activities, both in Mauritania and in other countries, through such means as data analysis and publication, workshops, and networking activities.

#### Project operation bases

The project will be structured according to a "bipolar" strategy based on the establishment of two sites: one support and distribution centre in the Trarza region at Rosso, and a technical, financial and administrative centre in Nouakchott. The Rosso centre is envisaged as the initial base of a future network of implementation centres located in various regions of the country.

Before the project can develop extension actions around the wind electric systems, it must initiate and support the creation of capacities for the provision, installation, and maintenance of the systems in Mauritania. Only then will the project be able to proceed to the field application phase, focusing on the rural areas selected as pilot sites. The initial phase will first be devoted to

establishing the infrastructure required for the manufacture, supply, installation, maintenance and repair service establishing the financing mechanisms for both suppliers and end-users, conducting the need and market studies, and performing the tests, assessment, and selection of the most appropriate wind electric systems.

The operational base in Nouakchott will be a resource centre, with expertise and know-how developed through direct participation of the team from the government (Department of Energy). It will also be a training and information centre for the private sector (concentrated in Nouakchott), and the NGOs whose staff will be trained to develop activities using similar materials and methods elsewhere. The tasks to be performed from each of the two operation bases of the project are outlined below:

#### *Nouakchott*

- Liaison with foreign and local private companies, including identification, training and monitoring
- Analysis and selection of the priority technologies, and organizing the call for bids
- Participation and monitoring of the work group for the study of a diffusion structure for rural electrification
- Implementation and monitoring of the experimentation base
- Actions in other regions of Mauritania (beside Trarza) more easily conducted from Nouakchott
- Market studies in the principal regions of the country
- Zone studies for the following expansion phase
- Possible launching of demonstration activities in regions other than Trarza, including Banc d'Arguin and Adrar
- Liaison with project partners, namely government services, NGOs and international organizations
- Development of financing for Phase 2, and support for integration of new and renewable energy in national policies
- Administrative management, such as telecommunications and transit
- Informing various audiences, such as government ministries and agencies, NGOs, the business community, and the public at large of project activities and about the wind technologies.

## *Rosso*

- Conducting community needs and market studies in the Trarza region
- Developing the information and implementation policy in the Trarza villages
- Installation of wind electric systems
- Evaluations of the impact of the installed systems on local communities
- Visits by other organizations and individuals to share information
- Monitoring and assessment of the installed systems and training of end-users to minimize abuse of the equipment.

This two-pronged implementation will be evaluated at the end of the first year by the Coordinating Committee and the Scientific and Technical Expert Committee's (STEC) evaluation mission in order to ascertain that the means used by the NGO are suited to the activities undertaken at each site.

### Selection of priority zones

#### *Preconditions*

A priority for the Project Alizés/é team will be to establish a typological classification of the regions and to select the pilot region(s). The specific priority zones and communities within these regions will be selected *on the basis of the ability and willingness of local communities to participate in the project*. The project is expected to have at least fifty sites equipped with wind electric systems (for example, Trarza villages, the Banc d'Arguin National Park, rural industries, and ecotourism sites). The team will develop and apply a classification and selection method in order to identify the most suitable regions and communities for the pilot applications of Phases 1 and 2 of the project.

#### *Classification and selection criteria*

The method applied for selection must be simple and explicit so it can be used by the principal participants, the Mauritanian government, the project team, local private companies, and the financial institutions funding the project.

#### *Phase 1 pilot regions*

The strategic objective of the project is to establish a technical and financial infrastructure for the supply, installation, and maintenance of the wind electric equipment, and related end-use appliances and equipment. In order to create the necessary experience and expertise, the project must be launched in areas where considerable human and institutional resources are available. The project will initially focus on one or two pilot zones, although it will examine the entire country by performing market studies and wind measurements elsewhere in the country.

The pilot regions and communities selected for Phase 1 must meet the following criteria:

- Direct, reliable access from Nouakchott

- An ability and willingness of participants to pay for part of the capital investment and all maintenance costs
- A sufficient level of economic development to permit financial participation in the project (partial equity in capital costs, full coverage of operation and maintenance contracts)
- No near-term (next three to five years) plans for electrification by SONELEC
- Sufficient facilities for housing, communication, and other requirements for the project team to operate effectively in the region
- Good wind resources (typically more than 4 to 5 metres/second mean annual wind speed)
- A minimum of ten to twenty communities that are good candidates for the use of wind electric systems
- The need for services that can be provided with small-scale electric power, and the potential for development of economic activities based on the supply of electricity
- The potential for attracting co-investments in both community services (for example, water pumping, public lighting, clinics and schools), and productive uses (small cash crop gardens, handicrafts, or fishing).

The region which best meets these criteria for the initial phase is the Trarza region, which is where the bulk of the activities undertaken during this phase will be concentrated. The project may also support a few test installations in other areas if the required technical, financial, and institutional conditions for success are present.

Examples of possible complementary sites are small fishing communities on the coast between Nouakchott and Nouadibhou, and some communities inside the Banc d'Arguin National Park. The project preparation team insisted on the importance of concentrating the limited resources available on developing sustainable diffusion capacities, and resisting the unavoidable solicitations to establish installations throughout the country, regardless of the degree of urgency with which they may be requested. Such installations could be set up earlier in the project, however, if other organizations such as NGOs, bilateral aid organizations, or government agencies were to provide the needed resources, with the Project Alizés/é team providing training and technical assistance.

### *Phase 2 diffusion regions*

The main objective for Phase 2 is to catalyze the diffusion of small wind electric systems. The Phase 2 regions are scheduled to be selected (or perhaps self-selected) during Phase 1. In areas with low population density, special strategies will be required in view of the small number of potential uses and difficult access. In those cases, the government or the foreign sponsors will undoubtedly require safe and constantly available wind electric installations.

Project Alizés has already received requests from people in remote areas who wish to have wind power mechanical pumps, and are willing to pay for the equipment and service. The challenge is to find a means to provide essential maintenance service in those remote areas.

### Implementation arrangements

#### *Support for national execution*

According to the provisions of Guideline UNDP/PROG/93/5 issued by the UNDP Administrator on December 17, 1993 (*Direct Country Office Support to National Execution - Modification of Current Procedure*), it is possible to support national execution of a UNDP project with a broader role than previously possible for a UNDP Country Office. The Government of Mauritania, UNDP Headquarters, and the UNDP Country Office in Nouakchott have agreed that the most efficient method to be applied for this project is a reinforced national execution in conformity with the spirit and the letter of the Administrator's guidelines.

According to these provisions, the Government of Mauritania, acting through the Department of Energy, will be responsible for the execution of the project. The Department of Energy and the UNDP office in Mauritania will have joint responsibilities related to the implementation and execution of specific project components, as detailed in this document. Backstopping assistance will also be provided from UNDP Headquarters to the UNDP local Country Office.

In its capacity as a supporting agency, the UNDP Country Office will contract directly with government-approved NGOs in order to make their services available to the project. The general framework and guidelines for this type of execution are contained in a signed memorandum of agreement. The Mauritanian Government proposed to retain GRET as the main implementing NGO, and UNDP Headquarters has approved GRET as the principal non-governmental implementing organization, contracting directly with the UNDP Country Office.

The project will be implemented jointly by the Government of Mauritania (Department of Energy) and GRET. The NGO Société d'investissement et de développement international (SIDI) will also work with the project to provide technical assistance, as well as managerial and financial support to local companies involved in supplying, installing, and maintaining decentralized wind electric units. SIDI, through its local office IDM, will be allowed to contract directly with GRET or with the local UNDP Country Office.

The project activities of the Department of Energy, GRET, and SIDI are specified in Section A, Subsection 4 and Section B, Subsection 4. Each organization has responsibilities and tasks that will be specified in the individual contracts with OPS. These organizations will work as part of a single project team, with an efficient project coordination and management structure. This structure involves three committees, as described below.

An independent Scientific and Technical Expert Committee (STEC) will be convened by UNDP Headquarters to ensure close monitoring of the project in view of this new execution modality. The Director of the Department of Energy will be the project coordinator.

## *Standing committees*

Three standing committees will provide guidance and support to the project: the Steering Committee, the Project Coordination Committee, and the STEC. The committees will be convened by UNDP and the Government of Mauritania as soon as practicable after final project approval.

### *Steering Committee*

The Steering Committee will be comprised of the Minister of Planning, who assumes the presidency of the Committee; the Minister of Water and Energy, who assumes the vice-presidency; and the UNDP Resident Representative in Nouakchott. The permanent secretariat is provided by the Project Coordinator (the Director of the Department of Energy).

The Steering Committee may invite other parties to attend its meetings, such as a representative of the implementing agencies (for example, the Department of Energy, GRET and SIDI) and others whom the co-chairpersons will select (private sector companies, financial sponsors, bilateral or multilateral agencies, NGOs).

The Steering Committee shall meet at the beginning of the project and annually thereafter to review project activities and progress. Its purpose will be to provide high-level oversight of the project, and ensure that the project's objectives are met. Either co-chairperson may call special meetings if the situation so warrants.

The Steering Committee will ensure project coordination and monitoring, as well as formulation of the funding plan for Phase 2. It will also contribute to the effective integration of wind technologies in the national policies of Mauritania in the areas of energy and rural development. For this purpose, the Steering Committee will be the preferred forum where specific information may be presented. Certain issues require that decisions be made at the national policy level in order to promote wind energy. The project will facilitate a dialogue with the Department of Energy and other government agencies on these various issues, and will seek to develop a portfolio of incentives to support this promotion. Included in the incentives could be tax relief measures for suppliers, or authorizations pertaining to rural electrification, or national subsidy policies on the level of support to be granted for rural electrical equipment. Developing such a portfolio based on the successful results obtained in the field will permit the use of wind electric systems in projects and programmes to be designed in Mauritania in the years ahead.

### *Project Coordination Committee*

The Project Coordination Committee will oversee the activities of the project on a regular basis, and will assist the project in dealing with specific issues and problems which may be encountered. This committee will provide active communication and coordination with key government agencies responsible for health, rural development, agriculture, electricity (SONELEC), and banking and finance (the Central Bank). The committee will also provide communication and coordination with specialized United Nations agencies (for example, UNICEF), SIDI, and other NGOs as appropriate. It will be chaired by the National Project Coordinator and will include representatives of government and UN agencies, SIDI, and other NGOs, as appropriate.



### *Scientific and Technical Expert Committee (STEC)*

An international expert council will be formed by UNDP Headquarters in order to provide scientific and technical support to Project Alizés/électrique on its behalf. The STEC, as described in greater detail below, will ensure the independent scientific supervision of the project. It will also provide direct assistance to the participants, both from STEC members and their institutions, to conduct an independent evaluation of the project for the UNDP Country Office.

#### *Composition of STEC*

At least one STEC member will participate in the yearly Tripartite Review. STEC members will remain in active contact with the project team, even between visits to Mauritania. The Committee will consist of three to five international experts with competency in the following fields:

- Decentralized rural electrification projects using renewable energy
- Technical expertise in wind electric technologies, such as air turbines, application systems, and field experience in the small to medium wind electric systems (0.1 to 50 kWe)
- Rural sociology/anthropology, with experience in assessment of the interactions between technical and social change
- Rural economics, preferably with experience in West Africa
- Technology transfer in developing countries, especially in West Africa.

Candidates will be proposed by the UNDP Country Office in Mauritania, UNDP Headquarters, the government (Department of Energy), and GRET, to UNDP Headquarters. Upon review of the qualifications and interest of the proposed experts, UNDP will select the STEC members. UNDP Headquarters will endeavor to gather a group of experts with diverse and significant experiences, both from developing and industrialized countries. UNDP will select among the STEC members a coordinator in charge of establishing essential liaison among the STEC, the UNDP Country Office in Mauritania, UNDP Headquarters, and the executing NGO (GRET).

#### *Funding of STEC activities*

UNDP Headquarters will directly assume the costs associated with STEC activities, using project funds allocated in the project budget for this purpose.

#### *Main responsibilities and activities of STEC*

The members of the STEC will be kept informed of the progress of the project through reports generated within the framework of the project and by direct communication with the project team. The UNDP Country Office will be responsible for communicating to them each of the reports as they become available.

Through an annual mission of one or two weeks in Mauritania, STEC will review the activities undertaken by the project and evaluate the quality of the execution by the various entities involved (local UNDP, GRET and the Department of Energy). This evaluation will take place immediately before the Tripartite Review so that the STEC members may participate in the Tripartite Review and present their observations and conclusions.

The STEC members will examine the proposed terms of reference as regards the international call for bids (ICB). They will also examine the responses submitted to the ICB, and communicate the appropriate comments and suggestions to UNDP Headquarters and the executing agencies.

The STEC members, and in certain cases the institutions with which they are affiliated, will be capable of responding to the requests for information as well as any request for assistance addressed to them from the project's executing agencies.

The chairperson for STEC will be responsible for ensuring:

- Cooperative relations between STEC and the participating entities
- Regular contacts between STEC and the executing agencies
- Circulation of information between STEC members
- Requests made directly to some STEC members for specific technical assistance
- Scheduling field visits with UNDP/Mauritania.

#### International call for bids (ICB)

The AGMOSS Committee at UNDP Headquarters has requested that a contract be signed with an independent organization working with GRET to conduct the ICB for wind energy equipment and related services. The purpose of this recommendation was to ensure that the call for bids be clearly defined and conducted broadly and impartially. The equipment technical specifications, costs, and availability must be evaluated. The capacity and commitment of the supplier(s) to establish a dynamic relationship with one or several Mauritanian firms in order to provide the equipment and maintenance service in a reliable and sustainable manner must also be evaluated.

In view of the requirements of the ICB, and the need for GRET to work subsequently in close cooperation with the international supplier, the chief of the preparation mission concluded that GRET should organize and make the ICB on behalf of the project. GRET will perform these functions while consulting and cooperating with an international centre specializing in small wind electric equipment, UNDP (Headquarters and the Country Office), the government, and members of STEC. This approach will ensure that the spirit of the recommendations issued by the AGMOSS committee be respected, in that the ICB will be independent, transparent and global, and that GRET will maintain its role as principal implementing agency. UNDP Headquarters, through its Regional Bureau for Africa/GEF, agreed with this procedure.

The ICB technical specifications will be prepared by GRET and the project team, and finalized by an expert in renewable energy having no connection and no potential interest with any equipment supplier involved in the call for bids. As regards this activity, the US National Renewable Energy Laboratory (NREL) will be requested to provide technical assistance. NREL has indicated an interest in assisting Project Alizés/électrique by hosting technical visits, providing technical information, answering specific technical questions, and cooperating in the preparation of the ICB and review of bids received.

### Participation of beneficiaries

The financial participation of the beneficiaries (communities and individuals) is necessary and constitutes a key strategic element of the project. Without it, there can be no test of genuine motivation, and therefore no assurances that maintenance will be kept up.

The Coordinating Committee will determine the required degree of financial participation by end-users for the first installations. The government, UNDP, and GRET will determine how these payments will be used during the project. In the meantime, the project will collect the funds and deposit them to a specific project bank account. It is proposed that all such funds be used to support the project directly, including serving as a contingency fund for unexpected costs, or to fund special opportunities not foreseen in the original project design.

### Main participating entities

#### *GRET*

GRET is a non-profit organization founded in 1976. Its primary mission is technical assistance for development. Active in forty countries, GRET has a total budget (1991) of US\$ 7 million. Its approach to development projects combines social, methodological, and technical innovation, and close cooperation with local partners. GRET operates in various technical fields, such as agriculture and animal raising, the urban sector, support to enterprises, exploitation of natural resources, and communications. Its actions in the field of development are centred on three main lines: direct project execution and implementation (a dozen projects are currently underway), expertise missions (identification, evaluation and consultation), and producing technical texts for the publication and dissemination of results obtained by all development actors.

In Senegal and Chad, for example, GRET is implementing a project for the creation of micro-enterprises to which it is providing advisory, training and credit services. GRET designs, implements, and manages credit services for local enterprises and development projects.

At the request of the Government of Mauritania, GRET has worked closely with UNDP and the government in the design and technical preparation of this project. The role and contributions of GRET have included:

- Secondment of GRET personnel for project preparation activities (in addition to UNDP-funded project preparation activities)

- Project pre-identification (1991-92)
- Participation in the drafting of the original project brief (June 1992)
- Collaboration in the development of the technical portfolio
- Follow-up of the project review by GEF
- Arranging agreements with the University of Nouakchott for project support
- Prior study of existing wind electric equipment
- Testing of three wind electric pilot systems with electronic data acquisition
- Participation in the drafting of the Project Document, assuming the cost of one engineer for 5 man-months (m/m) (Coopération Française funding) for project preparation.

### *Espace eolien régional (EER)*

EER is a French non-profit organization active in wind electric technology development and application. It provides advisory and technical assistance services, and conducts wind energy feasibility studies in France. EER is the principal technical consultant for Project Alizés; it conducted all pre-feasibility studies, and is involved in all technical decisions for the project. It played a crucial role in designing and installing the first and largest wind power plant in France, with a 300 kWe Windmaster turbine in Dunkirk. EER will continue to provide services for the diffusion phase of Project Alizés for the use of decentralized wind power generators in Mauritania.

### *SIDI and Investissement-développement en Mauritanie (IDM)*

SIDI is a French NGO capitalized at approximately US\$ 4 million, active in West Africa, South America, Central Europe, Asia and the Pacific. It was created in 1983 by the Comité Catholique contre la faim et pour le développement (CCFD). The objectives of SIDI are to support the establishment of local companies by entrepreneurs with profitable projects needing access to credit, and to encourage the creation and development of enterprises in the developing world. Within the framework of this start-up assistance, SIDI generally provides technical and management assistance, and frequently acquires a minority interest in the company.

SIDI has designed and implemented rural credit schemes in numerous countries, including neighboring Senegal. In Mauritania, SIDI created a local subsidiary, IDM, which is now working with refugees to help them establish small enterprises with SIDI participation, in addition to technical and financial assistance. IDM concluded an agreement with a private Mauritanian bank under which IDM will invest bank funds in local enterprises. IDM also recently created an association of Mauritanian business people, in cooperation with UNIDO.

The chief executive officer of IDM has suggested that IDM undertake the identification and development of the most appropriate financing mechanisms for both suppliers and rural users of wind electric systems and devices. SIDI is cooperating with Project Alizés to help install a 1 kWe wind generator system in a village to supply current for lighting, food refrigeration, and battery charging. The action of IDM concerns the supply of the equipment and credit to a local entrepreneur who is a refugee, and is therefore eligible for IDM aid under its contract with the EU for assistance to refugees. The equipment will be provided, installed, and financed under contract within Project Alizés/électrique.

### *The Melun-Sénart/Trarza Programme*

This effort is an innovative cooperative people-to-people programme between seven new towns near Paris, and seven secondary centres in Mauritania. The programme funded a borehole in the village of Tighent, for which Project Alizés supplied the wind pump equipment and all the assistance required for the implementation of the project.

In the village of Keur-Macène (approximately 1,200 inhabitants), a joint project for the supply of drinking water from the Senegal River is underway, using a wind electric pumping system for the pumping, filtration, treatment (chlorination), and sanitary storage and distribution of water. The programme provides complete assistance for implementation and maintenance. Until the installation of the water system, the village was being supplied by trucks carrying untreated water from the Senegal River. Residents have been chronically infected with bacteria and parasites from this water. The entire village now has reliable access to clean water. With this success, Project Alizés hopes to obtain support from the Melun-Sénart Programme to provide other villages along the river with similar equipment. These activities would then come under Project Alizés/électricité.

### *CARITAS*

CARITAS is an international Catholic aid organization focused on health and medical assistance. It supplies medicines and medical equipment at no cost, or at very low cost, throughout Mauritania, both in the villages and in urban centres. CARITAS is to cooperate with Project Alizés and the target villages for the electrification of health clinics and maternity units. CARITAS requested the help of Project Alizés to identify the possibilities of supplying electric power to health clinics in the Nouakchott area by means of wind power generating systems.

### *Nouakchott University*

Two Nouakchott University Institutes will participate jointly in the project: the Centre supérieur d'enseignement technique (CSET), a higher technical education institution, and the Higher School of Management. CSET will establish a base for experimentation on wind turbines, and the School of Management will participate by providing support in conducting surveys.

## **5. Reasons for GEF assistance**

The objective of the project is to establish a mechanism for sustainable diffusion of small-scale wind electric systems to support rural social and economic development in Mauritania, and to serve as a model for similar efforts elsewhere. The project is designed for a five-year period, with GEF funding of US\$ 2 million for an initial two-year phase, and other sources of financing for the US\$ 3 to 4 million three-year diffusion phase.

GEF assistance is required to facilitate the establishment of a local private sector-based infrastructure for assembly, installation, operation, and maintenance of small wind electric technologies, as well as associated systems for pumping, refrigeration, lighting, and other applications. The project is highly innovative, and as such it requires "risk capital" to demonstrate the potential for widespread use of small-scale wind electric systems for social and economic

activities, and to catalyze establishment of a sustainable technology delivery system in the rural environment of a traditional society. Support from GEF is appropriate because the larger context of the project is the development of effective low-carbon paths for rural energy development. Support from UNDP reflects the focus of the project on sustainable development.

If the GEF underwrites part of the initial investment in an infrastructure that can support the sustainable diffusion and operation of decentralized wind electric power units, the subsequent investments in the actual equipment will be more economic on an annualized basis than investments in fossil fuel-fired equipment. This example highlights the difference between maintaining a permanent subsidy for a particular class of investments (central thermal power plants), and an investment in an activity that will be economically productive and cheaper than the alternatives *once the technology delivery infrastructure is in place*, in this case for small-scale wind electric power systems. Once wind electric power equipment and its support are available on a routine commercial basis in Mauritania, the marginal costs of carbon offsets are expected to be negative. Local development goals and global environmental objectives are therefore addressed simultaneously.

## **6. Special considerations**

### **Project phasing**

The project design, as approved by GEF Participants at their December 1992 meeting in Abidjan, has a five-year, US\$ 4 million scope. Only US\$ 2 million were authorized by the GEF, however, with the requirement that the additional funds be sought from other sources of grant financing. Such a requirement is applicable to at least six other UNDP/GEF Fourth Tranche projects.

UNDP requires that a project document be prepared only for a project which is fully funded. UNDP cannot approve initiation of a project for which full funding is not available and committed. Consequently, the project development team prepared an integrated project plan fully consistent with the original project concept and scope, but divided the project into two distinct autonomous phases, each for separate funding. This Project Document is for the US\$ 2 million Phase 1.

The UNDP Country Office will conduct negotiations with donor agencies potentially interested in funding Phase 2. This approach preserves the original approved project design, permits the project to begin as soon as the document is approved, and provides a basis for donor participation, project evaluation, and preparation of Phase 2 financing.

This approach is fully consistent with the overall project concept and design, with an initial preparatory phase, and a subsequent technology diffusion phase. During the mission in Nouakchott, this approach was approved by UNDP/Mauritania and by the Government of Mauritania, and is supported by potential donors including the Coopération Française (CF), the Caisse Française de développement (CFD), and the Economic Development Fund of the European Union. Donor support for this approach was subsequently reaffirmed in a meeting with the representatives of the CFD in Paris.

### Phase 1: Individual use of small wind electric systems

Although Phase 1 is a preparatory phase to support the subsequent Phase 2 diffusion, there is already a commercial demand in Mauritania for individual (household) small wind electric power units. Such units, with power ratings typically in the range of 50 to 100 watts, can provide basic lighting, and communication and entertainment services. These units incorporate a wind electric generator, a battery, and a charge controller, and can include a small DC/AC inverter for small AC appliances (for example, television) if required. The local cost for such a kit, without the inverter, would be about UM 100,000 (US\$ 800) and, if financed at 10 percent per year for three years, would cost UM 3,350 (US\$ 28) per month.

The present Director of Project Alizés has received many requests for such equipment on a full commercial basis, and has also received requests for small water pumping systems (approximately 1 kWe), also on a full commercial basis.

During the initial phase of Project Alizés/é, some fifty small wind turbine kits will be installed in Trarza, and in the unelectrified peripheral zone of Nouakchott. Larger installations will be made for water pumping, provided the requests are backed by down payments, and with financial mechanisms to be tested for paying for these installations and their maintenance.

This activity will benefit the project in a number of ways:

- The very small wind electric systems are relatively simple and are an excellent entry-level wind electric technology for local Mauritanian companies to assemble, install and maintain.
- The introduction of the small autonomous systems on a commercial basis, early in the project, will establish the theme of cost recovery and the need for financial participation by the end user. The full capital and operating costs of the small units will be borne by the customer. For larger installations (1 - 10 kWe) for community social and economic development, the end users (beneficiaries) will be required to pay a portion of the capital costs, including a portion of the financing costs, and most or all of the operation and maintenance costs.
- The introduction of the smaller machines will permit the government, NGOs, and other project participants and collaborators to acquire immediate "hands on" experience with the equipment, and will facilitate technical training in preparation for larger and more complex systems.
- By installing some forty units at a relatively small total capital cost (around US\$ 50,000), it will be possible to elicit public response early in the project, and develop interest among the private sector, NGOs, and local communities. These installations will serve as a prelude to the introduction of larger machines, and more complex systems or packages (for example, for refrigeration, ice making and water pumping).

- Verification of the wind resources at many sites in the project pilot zones will be accomplished with these installations.

It will be necessary for one or more local companies to commit to the assembly, installation, and maintenance of the small wind electric systems. It will also be necessary for the foreign supplier(s) to provide, under contract, appropriate licensing, adequate training, training information, and other materials. These technology transfer-related costs for Phase 1 will be borne by the project. Depending on the local company or companies selected by the project for this effort, SIDI and IDM may intervene with both equity and debt financing, as well as with technical and financial training and support. This activity will serve to test and demonstrate the process of technology transfer and indigenization that will subsequently provide larger wind systems for both commercial and pre-commercial applications.

There are many reliable manufacturers and suppliers of proven commercial small wind generator packages in Europe, Asia, and North America. These companies can supply both individual wind electric generators, and complete packages incorporating batteries, controller, inverter, and end-use equipment such as water pumps and community lighting units. Prior to the start of the Alizés/é project, Project Alizés will collect data on suppliers, equipment, prices, and technical performance in field conditions similar to those encountered in the pilot zones.

### Project funding for Phase 2

A major objective of the Phase 1 activities is to secure the financing for Phase 2, and to have this financing committed in time to assure a smooth transition from the preparatory phase to the diffusion phase. Some debt financing to support revolving lines of credit for local suppliers and support organization, intermediaries, and end users will probably be required. The extent of this requirement depends on the future demand for financing from other organizations, and on the extent to which SIDI will be able to provide financing as loans to local supply and service organizations.

Preliminary meetings with the project preparation mission confirmed the interest of CFD in contributing to the financing of Phase 2. These contacts will be pursued and others will be initiated with international donors.

### Use of non-wind power generation equipment

Wind electric systems were selected for this project not only because there are very good wind resources in most of Mauritania, but because the technology is commercially available and warranted, has proven to be highly reliable in challenging environments, and, in good wind regimes, is typically less expensive on a life cycle cost basis than either PV units or conventional thermal engine options. The low operation and maintenance requirements of commercial small wind turbines is an important element in a strategy to bring decentralized electric power-based services to rural areas on a sustainable basis.

Over the past decade, many commercial small (1 to 10 kWe) wind turbines have operated with little or no maintenance for periods of five to eight years in harsh environments. However, the balance of systems, especially batteries (if required), controllers, pumps, and so on, will require



regular monitoring and maintenance for sustainable operation. This maintenance will typically be substantially less frequent and complex, and is expected to cost far less than operating and maintaining small high-speed diesel, kerosene, or gasoline engines.

While the technical focus of the project is on the use of wind electric systems for decentralized applications, it may occasionally be necessary to incorporate other technologies, such as PV arrays and thermal generators (for example, small diesel generators) in a wind electric system. This application will allow the optimization of the system to meet requirements for extreme reliability (vaccine refrigeration, for example). It will also minimize overall system capital and operating costs, and maintain the necessary charge state for long lifetime industrial deep-discharge batteries in those systems requiring batteries.

Where possible, *prepackaged commercially proven wind electric-based systems will be used*. It may be necessary, however, to conduct some systems design, engineering, packaging, testing, and evaluation if the project requires systems that are not available in the marketplace. GRET (with EER) and the Department of Energy will conduct experiments in France and Mauritania on different small-scale wind and hybrid power systems of special relevance to the needs of rural Mauritania. Equipment suppliers will be asked to participate in design, testing, and evaluation to assure that test results can be used for new product development and commercialization by local suppliers.

### The role of women

The project is expected to benefit women in several ways:

- The availability of abundant, clean water within the village can substantially reduce the incidence of death and disease among children, as well as the time and physical effort required to fetch water from more distant sources.
- Lighting and a broader use of the media, and television in particular, will open a window on the outside world, and bring information, culture, and entertainment to entire villages whose population consists mainly of women and children.
- The ability to engage in cash crop gardening will mostly benefit women.
- More generally, decentralized electrification allows increased comfort by providing lighting, refrigeration, availability of ice, and other benefits. An improved standard of living in villages mostly benefits women.

A highly qualified social scientist with extensive experience in these issues in Mauritania and elsewhere in Africa will participate in the inception of the project. Her participation will ensure that the project's implementation properly incorporates these issues.

### Environmental impacts

The project will result in minor but highly visible changes in the local physical environment, primarily through water pumping, and the resulting increase in irrigation. Care will be taken to

ensure that local water tables are not drawn down; this possibility is not considered a significant issue for small villages in Trarza, but could affect the long-term viability of oases in the northern part of the country.

From a global perspective, the project addresses the need for low-carbon and carbon-free alternatives to fossil fuel-based rural development strategies.

### *Impact on the global environment*

An important part of the activities of the GEF consists in helping to mitigate the impact of human activity on the greenhouse effect. Approximately half of the gas emissions influencing the global climate system are due to hydrocarbon and fossil fuel combustion, and the associated carbon dioxide emissions. Therefore, improving the energy yields at the production and transportation levels, and replacing fossil fuels with renewable energy and other primary non-carbon-producing sources of energy are basic elements of an overall strategy aimed at reducing carbon dioxide emissions.

The consumption of petroleum products for rural electrification is not presently a major source of carbon dioxide release. There is, however, a noticeable, rapid acceleration of the pace of rural electrification in virtually all developing countries, most frequently using diesel engine generators and power network development. Although carbon dioxide emissions are low in the rural energy sector, the sector will grow dramatically over the coming decades.

If, over the next fifty years, 1 to 3 billion rural inhabitants consume electricity at an average rate of 100 watts per person, the annual carbon dioxide emissions from diesel generators will reach 2 to 6 billion tons, and the electric networks will equal or exceed this level (if the energy sources are the conventional oil-fired type). For comparison purposes, one should recall that in 1985, total carbon dioxide emissions were estimated at being between 21 and 29 billion tons, of which 19 billion tons were from fossil fuels.<sup>5</sup>

There is therefore an excellent opportunity to curb the increase of carbon dioxide emissions within the context of rural electrification by adopting energy policies favoring sources with low carbon dioxide emissions. The impact of Project Alizés/é on the global environment is linked to its potential value as a viable, replicable model for low-carbon paths for the development of rural electrification.

### Technical cooperation among developing countries

The project is directly relevant to the needs of most developing countries with regard to facilitating social and economic progress in rural and peri-urban regions. During Phase 2, there will be a major effort to link institutions in other developing countries with the project through workshops, publications, and dissemination of a videotape on the project. During the initial phase,

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<sup>5</sup> The broad estimation range is due to the uncertainty about the share of carbon dioxide emissions resulting from deforestation.

participants in the project will meet occasionally with their counterparts in other UNDP and UNDP/GEF projects with similar objectives for the development of decentralized electrification and rural equipment.

### Collaboration with NGOs in Mauritania

Collaboration with several NGOs has been incorporated in the project from the stages of conceptualization to the preparation of the first project brief. The approach is to facilitate co-investment in wind electric systems (by the project), and in social and economic development activities by NGOs, bilaterals, multilaterals, and the Government of Mauritania. The project will also develop suitable in-country mechanisms for financing private sector suppliers of equipment and services, intermediaries such as NGOs, and end-users (communities and cooperatives).

This approach of Alizés/é specifically and deliberately attempts to avoid the pitfalls of many grant aid projects in which technical demonstrations of renewable energy equipment were carried out without establishing a capacity for operating, maintaining, and repairing the systems, without financing, without a clear focus on the commercial production and diffusion of the equipment in the host country, and often without consideration of the reliability and commercial status of the equipment. Most such demonstration systems of solar thermal, solar electric, and wind electric technologies have long since failed to operate; many of them stopped working within weeks or months of installation. The role of demonstration installations in Project Alizés/é will be to test operation under harsh environmental conditions, to show the kinds of applications that small-scale wind technologies can support, and to provide a basis for private sector decisions regarding entering the wind electric equipment supply, installation, and support business.

The infrastructure to support the sustainable diffusion and operation of decentralized renewable energy-based power systems and end-use equipment will consist of a private sector-based rural electric services enterprise, a local financing mechanism for both suppliers and end-users, and technical support from foreign suppliers and technical experts.

The financing mechanism will finance private sector suppliers of equipment and services, intermediaries (such as NGOs) who may wish to install and support applications like village water systems, and end-users, such as a village cooperative or an association of fishermen. For example, a fishing community would make an initial down payment of perhaps 10 percent of the cost of the equipment, and would then make monthly payments to cover the capital and financing costs of the equipment, as well as the maintenance and repair. The equipment would be guaranteed with maintenance support by the rural energy services enterprise.

### Co-investments in social development

#### *Collaboration with UNICEF*

Investments in the supply of electricity from wind electric power units will be linked when possible with investments in priority social services. The director of UNICEF/Mauritania has indicated his willingness to have UNICEF invest in equipment and training for small medical clinics if Project Alizés/é provides reliable electricity for these applications and for other urgently needed

services, such as electric water pumping from covered wells. UNICEF has developed a five-year plan (1994-99) for their activities in Mauritania.

The plan reflects the commitment of UNICEF to integrated rural development, in which the provision of clean water, health services and medicines, and improved nutrition are addressed simultaneously. UNICEF is also concerned with the support of local microenterprises such as small gardens for raising cash crops. In this case, both the physical and economic health of the community can be improved. UNICEF is pursuing a strategy that reflects the goals and philosophy of the Bamako Initiative, a client-focused system for health development and community initiatives.

One of the two pilot regions selected for the initial phase of Project Alizés/é is Trarza, with additional installations projected for the coastal area between Nouakchott and Nouadibhou. While there are substantial needs for water, lighting, and other electricity services in other regions of the country, these cannot be reliably served using small wind generator systems until the infrastructure for these systems is in place. UNICEF is also active in Trarza, in areas where there are good wind resources. Project Alizés/é can support UNICEF in its integrated rural health development efforts by providing reliable and affordable electricity services for the UNICEF programme. Project Alizés/é plans to work closely with UNICEF to define the requirements and specifications for the electric power supply, and to support several prototype installations in local communities.

With this experience it will be possible to identify specific opportunities in the country for linking wind electric power systems and applications that support UNICEF program goals. It will also be possible to determine the potential extent of these applications, and the opportunities for partial or full-cost recovery from the communities served, either for the capital and operating costs of the wind electric power system, or for the operation and maintenance costs alone. Once Project Alizés/é begins, UNICEF and the project team will work together to define a concrete plan of action for collaboration on UNICEF's health-related programs.

There is presently modest collaboration in Trarza between UNICEF and Project Alizés to use wind electric water pumping in the village of Keur Macene to provide potable water from the unsafe water of the Senegal River, with water treatment before distribution. UNICEF is also financing the construction of five boreholes within Project Alizés.

#### Co-investments in economically productive activities

##### *Desalination, refrigeration, and ice making for fishing villages*

Fishing villages along the coast between Nouakchott and Nouadibhou have highly productive and profitable small-scale fishing. These villages are located in a zone that is not electrified, and has no fresh water. Consequently, all fresh water is brought in at considerable expense using trucks. These villages want and need a cheaper source of potable water, refrigeration facilities to preserve the fish, and flake ice production units to permit transport of the fish to market with minimum degradation. The coastal zone north of Nouakchott has outstanding wind resources so the annualized cost of electricity from wind generators will be well below those of any other alternative, including diesel generators.

During its initial phase, Project Alizés/é will assess the specific priority needs of a number of fishing communities along the coast, and the potential economic benefits of having reliable sources of fresh water, refrigeration, and flake ice available. One donor agency has held informal discussions with the Department of Water about the possibility of providing financial and technical assistance to introduce mobile reverse osmosis (R/O) desalination units along the coast for the use of these communities. As in the example of a small-scale irrigation project, Project Alizés/é would explore the potential for collaboration to provide the necessary electricity for desalination, ice making, and cold storage facilities from wind electric power systems. This potential again illustrates the importance of co-investments in wind electric power and associated economically productive activities.

### *Laitière de Mauritanie*

The Laitière de Mauritanie (Mauritanian dairy company), an internationally recognized, highly innovative private sector venture, is developing a modern dairy industry in Mauritania with milk from camels and indigenous cows. To gather and preserve the milk supplied by many individuals, the company provides refrigerated milk storage units distributed throughout the collection region. These systems require continuous electrification, with peak power levels of 2 to 6 kWe, and continuous power in the range of 0.5 to 2.0 kWe, depending on the size (500 to 2,000 litres) of the storage unit. Many of the units are located in windy areas, where wind electric units, with a small thermal engine/generator backup, could provide reliable power at annualized costs below those of small generators, and with much less required maintenance.

The Director of the Laitière de Mauritanie has offered to cofinance a pilot installation in which Project Alizés/é would configure and install the integrated wind electric power system using commercial components, and the company would provide the milk storage unit for test and evaluation of the wind electric power application. A 500-litre milk refrigeration and storage unit requires peak power of 2.5 kWe for several hours to cool the milk to 4°C within two hours, and lower running power (approximately 500 We) to maintain the milk at this temperature. Larger 2,000 litre units require a peak power of 6 kWe. This appears to be an excellent technical application for wind electric power, with suitable battery and/or thermal engine generator backup. It is also an application that can provide the electricity required to support rural economic development with strong environmental benefits.

### *Cash crop gardens*

The experience of Project Alizés shows that with excess water from a wind pump, some small villages can plant, harvest, and sell vegetables such as tomatoes and onions at a substantial profit. An important side benefit of this activity is to improve the level of nutrition for the village.

One village equipped with a wind mechanical water pump by Project Alizés had a large profit in its first season of growing vegetables. The profit was equivalent to about half the installed cost of the well, wind pump, storage tank, and water distribution system. If agricultural extension services are provided to villages in conjunction with the installation of wind electric water pumps, similar profitable economic activities can be expected. Project Alizés provides some technical assistance to the gardens.

### *Small-scale wind electric irrigation—an example from Indonesia*

Within its development aid programme, the Japanese government is supporting a project (Small-Scale Irrigation Management Project—SSIMP) for small-scale irrigation of existing farming plots in Timor, Indonesia. The original project plan included the use of small, relatively inefficient kerosene engine/generators to power 240 individual small irrigation pumps. In a typical application, a 2 kWe kerosene pump operates against a dynamic head of 4 metres and can pump about 50 metres<sup>3</sup> of water per day.

The Government of Indonesia has adopted a deliberate policy of reducing the growth in consumption of diesel and kerosene fuels in both rural and urban areas. To explore non-fossil fuel alternatives to kerosene pumps, the Japanese project management, with support from the United States Agency for International Development (USAID), installed a 1.5 kWe Bergey<sup>6</sup> wind electric pumping system using a Grundfos 1.5 horsepower (Hp) centrifugal pump at one of the demonstration sites in October 1992. If the results of the one-year test continue to be encouraging, the project intends to equip as many of the 240 sites as possible with wind pumps.

The wind resource at the site is decent but not spectacular; technical performance and economic analysis were based on an average wind speed of 4.6 metres/second. In the Project Alizés target region of Trarza, the wind resource is very similar, although in much of Mauritania the average wind speeds are substantially higher. The projected average production, based on field tests, is 150 metres<sup>3</sup>/day, equivalent to the output of three 2 Hp kerosene pumps. The pilot installation, which has been operating continuously since its installation, is delivering 3-6 litres/second for at least eight hours per day (130-180 metres<sup>3</sup>/day).

The initial capital cost of the wind turbine, tower, pump, and controller was US\$ 7,000, including shipping and installation. The initial capital cost is about six times that for the kerosene-powered system, but the projected lifecycle costs are about half those for the kerosene pump. The operation and maintenance costs of the kerosene pump are about twenty times greater than those of the wind pump.

Similar small-scale rural irrigation projects are under consideration for Mauritania by at least one bilateral aid agency. For regions with good wind resources, these projects would offer an important opportunity for collaboration between the (separately financed) irrigation project and Project Alizés/é. Project Alizés/é will work closely with the Direction d'hydraulique of the Ministry of Water and Energy to identify and implement such opportunities.

## **7. Coordination arrangements**

UNDP will initially coordinate the activities of the various agencies directly involved in the project and the other national and international organizations. The Department of Energy will be responsible for all of the coordination with the various line ministries concerned with the project.

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<sup>6</sup> Bergey Windpower, Norman, Oklahoma (USA) is a leading supplier of wind turbine generators in the range of 1 - 10 kWe.

The Coordination Committee will be the primarily responsible for implementing this activity, and for working with all state services and directly concerned bodies. As the main implementing agency, GRET will also be responsible for ensuring coordination between these various entities.

Of particular importance is the coordination among NGOs: between GRET and IDM (SIDI) as concerns the support to small enterprises and the financial mechanism, and between GRET and EER for wind and electrical technical aspects.

The wind energy applications considered under this project are aimed at a broad variety of rural development programmes in such areas as water resources, health, sanitation, agriculture, education, and microenterprises. The project team will work with the key ministries and projects in order to integrate the use of wind power equipment in their social and economic activities. The project will also work with bilateral donors. The project will cooperate with the following entities involved in rural development activities requiring, or strongly promoting, the use of electricity:

- Government services: Department of Water, Fisheries, Ministry of Health
- UN agencies: UNICEF, UNIFEM, FIDA, WHO
- NGOs: CARITAS, SIDI.

Finally, the project team will work in close cooperation with grassroots organizations, at the village and intervillage levels, either with existing groups or with emerging groups whose creation will benefit from the project. Within this context, the project may be called upon to cooperate with international volunteer organizations (Peace Corps, UNV, AFVP, and others).

## **8. Counterpart support capacity**

The present counterpart capabilities of the Mauritanian government are inadequate. One of the project's objectives is to enhance the capacities for implementation of the activities in the area of electrification and/or renewable energy resources.

The government (Department of Energy) will second an engineer who will be assigned to the GRET implementation team. It will also contribute to the staffing of the project by seconding another engineer within the Department of Energy framework, with office and backstopping support. The counterpart contribution of the government is listed in the counterpart budget. It totals UM 8-,894,621 for the first two years, and is provided exclusively in kind.

The Department of Energy already has experience with renewable energy, and strong experience with technology diffusion through a country-wide programme on improved stoves now completed. The project will work on capacity and resource building within the Department of Energy, mainly through the participation of an experienced engineer assigned to the project team, and training of Mauritanian engineers, both in Mauritania and abroad. The project will also involve the Department of Energy in the creation and use of a technical mechanism in Mauritania to test and evaluate small wind energy systems. The programmes conducted by the Department of Energy include (see Section A.3):

- A national butane gas programme (ongoing since 1992)

- A regional solar programme (ongoing since 1992)
- An improved stove diffusion programme (ongoing since 1987)
- Project Alizés for wind mechanical pumping in Trarza (ongoing since 1990).

The government will also contribute to the project by providing support for the following specific activities:

- Possible involvement of the Central Bank in the loan programme
- Facilitating the circulation of goods and persons into and out of the country
- Supporting the relations between the various ministries and public entities.

### C. DEVELOPMENT OBJECTIVE

The overall project objective is to promote sustainable development by improving the quality of life and the socioeconomic situation of the rural populations through installation and diffusion of small decentralized wind electric equipment at the local and national levels. This effort enables Mauritania to participate in the efforts aimed at mitigating global warming.

The primary development objective of the project is to establish a successful widely-used mechanism for sustainable diffusion and support of small-scale decentralized power generation units. Units using wind energy as a form of pre-electrification to support investments in social and economic development in rural Mauritania will be installed. The principal innovation being tested in this project is not technical; it is the development of a *sustainable delivery system to support decentralized applications of renewable energy for development*.

The strategic goals of Project Alizés/é are to demonstrate the technical, economic, and institutional feasibility of sustainable large-scale diffusion and application of small-scale wind electric power technologies, and to provide a model for similar applications throughout the developing world where there are sufficient wind and/or solar energy resources.

The five-year goal of this project is to bring electric power services for important social and economic (productive) uses to about 100 villages (about 20,000 people) through the use of small- and medium-scale wind electric power technologies. Another goal is to establish a self-sustaining private sector-focused mechanism and infrastructure for the delivery of rural electric power services that can extend throughout the windy regions of the country. The project will build on the current highly successful Project Alizés, which has brought reliable access to clean drinking water to some fifty villages using wind mechanical pumping technology, coupled with an infrastructure for installation, maintenance and repair.

Specific project objectives include:

- Determining the markets and opportunities for use of small-scale wind electric technologies in the rural sector
- Establishing the technical, financial, and institutional mechanisms for introduction and sustainable diffusion of these technologies



- Developing a practical strategy to accomplish this goal
- Launching an effective programme of wind technology applications, initially focused on the southwest region of the country.

#### **D. IMMEDIATE OBJECTIVES, OUTPUTS, AND ACTIVITIES**

##### **Preliminary remarks**

Listed below are the objectives, and the outputs and activities required to achieve these objectives, as well as the persons or teams involved. The activities are presented in great detail in view of the extensive discussions conducted by the project identification team, in keeping with the wishes of GEF Participants. Since the initial project plan cannot reasonably be expected to foresee every detail, however, maintaining substantial flexibility in project implementation is essential for success. Added to the usual periodic review mechanisms are the supervisory activities of the NGO itself and the International Scientific and Technical Advisory Committee. These entities will periodically review and approve the strategic choices made within the project, while granting broad latitude to the NGO as required for the formulation and implementation of creative solutions—an absolute requirement if the objectives of this project are to be met.

##### **IMMEDIATE OBJECTIVE 1**

Identify, test, and assess appropriate technical, social, and economic opportunities for the use of wind electric equipment in rural areas.

##### **Output 1.1**

Study of the market for pre-electrification equipment that can support social and economic development in the rural regions of Mauritania. This study will first analyze the economic and social needs of these regions. It will be completed by the end of Phase 1.

##### **Activities for Output 1.1**

- 1.1.1 The project team will conduct a study for the six principal regions of Mauritania: Adrar, les Hodh, Trarza-Braknha, the coastal zone, Gorgol-Guidimakha, and Tagant-Assaba.

One component of the study will develop an inventory of needs and the potential options for meeting these needs. This effort will start by reviewing the economic and agricultural activities in each region, the existing infrastructures supporting these activities, the socioeconomic and cultural characteristics within each region, and specific identified social and economic development needs. The study will identify specific needs of women to encourage the use of specific technologies, as the economic situation will allow, in order to improve the conditions of women in each of these regions.

A second component of the study will focus on collection of relevant economic data:

- The patterns of energy use, and the performance and cost of energy sources and technologies will be documented, especially for those systems which can in principle be replaced or supplemented by wind electric applications (borehole pumping, river pumping, kerosene refrigeration, small generators, and so on).
- The willingness and ability of various communities to pay for wind electric-based services for comfort, production, daily purchases, and other uses will be evaluated. The sources and amounts of income, and resources to guarantee loans, will also be determined.

This work will be conducted in part using existing studies, and will also be based on interviews conducted in Nouakchott and regional centres. There will be a review of previous and ongoing projects in which financial participation by end-users has been required. One result will be an overview and presentation of the characteristics of various regions, and the potential for use of various wind electric-based systems.

- 1.1.2 In the study of regional needs, the existing organizations in the various regions, and their interest in the use of decentralized small wind electric systems will be identified and characterized. Potential project partners will be identified. Other projects, and associated institutions with the same needs which can use decentralized wind electric power units within the framework of Project Alizés-électrique, will be identified and inventoried.
- 1.1.3 Field survey workers will be selected and trained. The field survey instruments and methods for using them, as well as the mechanism for validating the information obtained from the instruments, will be developed.
- 1.1.4 The field surveys will establish the present patterns of rural energy consumption, and will identify potential activities that may be possible from the availability of decentralized electric power. The field surveys will focus on a small number of villages which will be studied intensively. The goal is to have a cross-section of representative villages or communities for which detailed energy use data and potential energy demand forecasts are available. Within a group of identified communities with similar sociocultural and socioeconomic characteristics, one or more villages will be selected at random for intensive survey. In each of the survey regions of Mauritania, five or six villages will be chosen for intensive surveys.

For the region of Trarza, two villages will be chosen for each sociocultural/socioeconomic class, in order to conduct a more detailed assessment.

The surveys will be conducted in two phases:

- The initial surveys will be conducted in three priority regions: Trarza, Adrar, and the coastal region. They will be conducted during the first six months of the project.
- The surveys for the three remaining regions will be conducted during the second six months of the project.

*Survey of current energy consumption patterns.* This survey will develop a list of existing uses of energy, the expenditures for these uses, and the characteristics of the applications. It will also identify energy-related factors constraining development.

*Survey of potential needs.* Potential applications of small decentralized wind electric power generation units will be identified, together with their costs and an identification of factors which limit their use today. The initial results of a study of the impact of six small wind electric power units to be installed within the framework of Project Alizés (see Activity 1.2.2) will guide the analysis of potential applications. Options for the use of wind electric units in combination with other sources of energy (for example, with backup thermal generators or PV power generation units) will be identified for both immediate and future applications.

The surveys will be realized by the project team, with assistance from two experts. The project will explore the potential for obtaining support for the field surveys from the University of Nouakchott, by means of assigning students from the School of Economic Science to work on these surveys. The purpose is not to save on labor costs, but rather to take advantage of existing expertise and experience within the university. This support will establish an ongoing collaboration between the university and the project, and provide an opportunity for students and faculty to develop and apply socioeconomic and sociocultural skills in rural field work. This goal is consistent with national educational policy.

- 1.1.5 The principal pilot zone is already defined; it is the region of Trarza. A second pilot zone is to be chosen based on socioeconomic and technical considerations. Technical considerations might include the opportunity for use of technologies not applicable in Trarza. The definitive choice will be made in conjunction with the results of the field surveys and assessments.

#### **Activities, responsibilities and support for Output 1.1**

|       | <i>Activities</i>                                     | <i>Responsibilities</i>                      | <i>Support</i>         |
|-------|---|--|------------------------|
| 1.1.1 | Regional needs study                                  | GRET project team                            | Morocco project expert |
| 1.1.2 | Identification of potential partners and co-investors | GRET project team                            |                        |
| 1.1.3 | Preparation for field surveys                         | GRET project team                            | GRET experts           |
| 1.1.4 | Field surveys   | GRET project team                            |                        |
| 1.1.5 | Definitive choice of pilot zones                      | Coordination Committee and GRET project team |                        |

## **Output 1.2**

Identification and definition of the various end-use technologies to be used with small-scale wind electric power generation units; analysis of their costs (including installation, operation and maintenance), and comparison of their technical performance and costs with those of other energy systems and end-use options for priority household, social, and economic activities. This output is to be obtained by the end of Phase 1.

### **Activities for Output 1.2**

1.2.1 A technical survey will be made of the relevant systems able to meet the needs as identified. This survey will be international in scope, using the networks of the various project partners, and will seek to identify integrated systems (wind power generator and associated equipment) already existing and with good references.

1.2.2 Project Alizés installed six wind electric units in Trarza, one in 1992 and five in June 1993. These include three LMW model 1003 (1 kWe) wind turbines for three distinct applications: water pumping, power for a microgrid for community lighting, and a commercial operation including cold storage and battery charging. The other three installations use small Marlec 70 We wind turbines, one for lighting and two for medical refrigeration in dispensaries.

Review of these installations will permit an analysis of their technical performance, costs, and social impacts. The results of the initial assessments will help guide the selection of equipment for Project Alizés-électrique, and determine the financial requirements for the initial installations in the pilot zones. The method of review and assessment of these wind electric units will be similar to that used for review and assessment of installations made under Project Alizés-électrique (See Output 1.5).

1.2.3 Using the results of the regional analysis of needs and markets, and the detailed surveys, the technical and economic specifications of alternative approaches to satisfying specific needs of communities and the private sector will be identified. These specifications will stipulate the nature of the service expected, both qualitatively and quantitatively, the limits on acceptable costs, and the specific constraints for each application. These technical specifications will provide the basis for the definition and selection of the technical approaches to be tested.

1.2.4 After identification of the equipment and services available in the international marketplace, and the identification of the priority needs for Mauritanian communities, suitable systems will be selected for installation and evaluation. The selection will be based on:

- Estimated capital and operating costs of the systems themselves, and comparison with competitive models
- Availability and quality of supplier support for in-country service
- Potential for widespread use and diffusion in the pilot zones and in Mauritania.

Two consultants (one engineer with expertise in electrical applications and wind electric power systems, and one socioeconomic expert) will assist in the selection of priority technologies.

The Coordination Committee will be presented with the various alternative applications and methods, and will assist the project team in the final selections of the technologies for the test and demonstration phase.

- 1.2.5 The various technical approaches proposed for diffusion will be presented with an analysis of the financial requirements for their diffusion. The costs will be presented both in terms of capital, operating, and annualized costs, and in terms of the costs of the specific services provided (for example, cost per kWh of electricity, or cost per cubic metre of water delivered). The financial analysis will consider the economic and financial requirements for return on investment over a period of five to ten years. A proposal for funding support will also be presented, with various arrangements based on the types of applications.

The goal is to define the conditions for economic profitability taking into account the technological choices. These projections will then be analyzed and compared with actual data during the test phase, and will be reviewed at the end of Phase 1 based on field data.

#### Activities, responsibilities and support for Output 1.2

|       | <i>Activities</i>  | <i>Responsibilities</i>                     | <i>Support</i>                             |
|-------|--|---|--|
| 1.2.1 | Collection of technical data for available systems                     | Wind electric experts 1, 2 and 3            | GRET project team<br>GRET/EER support team |
| 1.2.2 | Review and assessment of wind electric installations of Project Alizés | GRET project team                           | GRET support team                          |
| 1.2.3 | Definition of technical specifications                                 | GRET project team                           | GRET support team                          |
| 1.2.4 | Choice of priority technologies  | Coordination Committee<br>GRET project team | Wind electric expert<br>GRET support team  |
| 1.2.5 | Determination of the financial conditions required for diffusion       | Coordination Committee<br>GRET project team | GRET support team                          |

#### Output 1.3

Selection of wind turbines and associated equipment appropriate to the conditions of the Mauritanian market. Selection of suppliers and Mauritanian enterprises to install and maintain the equipment. This output is to be obtained by the end of Phase 1.

### Activities for Output 1.3

- 1.3.1 Two short lists of wind turbine equipment suppliers will be drawn up. One will be for suppliers of small wind turbines (approximately 500 We and less), and one for suppliers of larger units (500 We to 5 kWe). A maximum of four suppliers will be selected from each list based on actual field references, and on their interest in establishing a technical partnership with a Mauritanian enterprise. Firms on the short list will be invited to send in bids.

LMW (Netherlands) and Bergey Wind Power (USA) are two suppliers of large machines who have experience in international development applications of wind electric systems. These companies have indicated their interest in Project Alizés-électrique. They will be included on the short list of potential suppliers of equipment and services.

Available data on technical performance for each wind turbine and system will be compiled based on tests conducted by independent laboratories not affiliated with the supplier. In the absence of such data, testing will be conducted by an evaluation centre such as the University of Eindhoven, Netherlands, or an American laboratory.

Data on the use with related equipment will also be presented, with mention of the number of references, the results obtained, and external assessments.

This inventory will be established by the support team (one or two international experts), together with GRET and EER.

- 1.3.2 The technical specifications for an international competitive bid will be established. These specifications will be prepared jointly by GRET and the project team, and will be finalized and drafted by a wind energy technical expert independent of potentially interested commercial wind equipment suppliers.

Some of the important criteria in the choice of suppliers will include: the number, type, and quality of field installations; price and performance of equipment under a variety of field conditions and end-use applications; and the potential for, interest in, and capacity to support technology transfer. These technical specifications will form the basis of an international competitive bid which will be issued to select a wind turbine supplier. The weighting of each selection criterion will also be established.

- 1.3.3 An international competitive bid (ICB) will be issued to companies on the short list. The call for bids will be for the purchase of equipment in conjunction with the provision of technology transfer services for wind energy equipment. In particular, the supplier will have to commit to technology transfer procedures, technical monitoring, and training, which it will then provide to the selected local companies. There will be an option to purchase a limited number of wind turbines (a maximum of twenty) during the initial phase of the project. The project will provide financial support to selected suppliers for technology transfer.

The competitive bid will first be concerned with the wind turbines themselves. The applications and systems proposed by the suppliers will be assessed. However, the project

will not be required to select all of the equipment proposed by the wind turbine supplier. GRET will, in consultation with the wind turbine supplier and the support team technical experts, have the option of selecting other associated equipment if these apparatus are more advantageous.

- 1.3.4 The bids will be received by the project team in Mauritania.
- 1.3.5 The bids will be reviewed in accordance with previously established evaluation and selection criteria. An international expert in technology transfer will assist the project team. The choice proposed by the project team and the expert consultant will be discussed with, and finalized by, the Coordination Committee.
- 1.3.6 It will be essential to select a Mauritanian enterprise interested in, and capable of, supplying and installing the equipment. Some aspects of the supply and installation may be sub-contracted to other local enterprises. With regard to maintenance and repair of equipment, approaches appropriate to each set of applications, and in each geographic zone, will be established. Maintenance by a company present in the focus area or possibly from Nouakchott will also be considered. In all cases, the purpose will be to establish a commercial relationship between the clients and the supplier.

An inquiry will be conducted in Nouakchott regarding enterprises capable of providing high quality services, avoiding organizations without adequate demonstrated business experience and success. The project formulation mission has identified three companies in Nouakchott which have indicated their desire to become involved in supply, installation, and service of wind electric equipment. These firms are Deyloul, the Bureau technique d'intervention (BTI), and SOMER. Their capabilities are complementary, and a commercial collaboration among these enterprises may constitute a viable approach. Because of the limited market (approximately 100 installations over the first five years), it is not considered necessary to support the establishment of more than one capable commercial enterprise for supply and support. Rather, the objective will be to form a special partnership based on careful training and monitoring of one local enterprise.
- 1.3.7 Local enterprises will be selected by the project team and invited to submit an offer, either individually or in concert with other local companies. The terms of reference will require that the companies provide a basis for evaluating the following aspects: competence, importation of supplies (and therefore hard currency), maintenance in rural regions, company commercial policy, ability to invest (inventory), and others. This competition will not constitute a formal bid, but rather an opportunity for local companies to propose collaboration with the project.
- 1.3.8 The companies selected during the preliminary survey will be informed of the competition.
- 1.3.9 The proposals will be directed to the project team.
- 1.3.10 After the proposals have been reviewed and assessed, one or more local enterprises will be selected to participate in the project. The assessment will include visits by the supplier who

will meet with the various candidates and visit their past installations. The choice will be made by the project team, an expert mission, and the supplier. It will be submitted to the Coordination Committee for discussion and final approval.

### Activities, responsibilities and support for Output 1.3

|        | <i>Activities</i>   | <i>Responsibilities</i>  | <i>Support</i>                                |
|--------|---|--|---|
| 1.3.1  | Inventory of existing systems   | Wind electric experts 1, 2 and 3                                     | GRET/EER support team<br>GRET project team    |
| 1.3.2  | Defining technical specifications for selection of wind turbine suppliers | Wind energy expert 1   | GRET project team<br>GRET/EER support team    |
| 1.3.3  | International bid for supply of wind turbines                             | GRET project team  | Wind energy expert 1<br>GRET/EER support team |
| 1.3.4  | Receipt of the bids   | GRET project team  |   |
| 1.3.5  | Bid review and selection of suppliers                                     | Technology transfer expert<br>Coordination. Committee                | GRET/EER support team                         |
| 1.3.6  | Inquiry on local enterprises  | GRET project team  | GRET/EER support team                         |
| 1.3.7  | Draft terms of reference of competition for local enterprises             | GRET project team  | Wind energy expert 1<br>GRET/EER support team |
| 1.3.8  | Announcement of the competition   | GRET project team  |   |
| 1.3.9  | Receipt of proposals of local enterprises                                 | GRET project team  |   |
| 1.3.10 | Proposal review and selection of local enterprises                        | GRET project team<br>Wind turbine supplier<br>Coordination Committee | GRET/EER support team                         |

### Output 1.4

Installation of complete wind electric systems for test and demonstration in the project pilot



zone. The number of sites to be equipped will range from fifteen to twenty. This output is to be obtained by the end of Phase 1.

Several different technical systems (approximately five) will be installed for test and evaluation, some of which may be installed in complementary fashion at one village site. These installations will be selected in conjunction with the field surveys of needs and potential markets, and after review of available technologies and packaged systems. Small wind turbines for individual use will also be installed at one or two sites.

#### Activities for Output 1.4

- 1.4.1 Within the first three months after project initiation, two wind turbine units will be installed at the experimental site of the Department of Energy and the University of Mauritania in Nouakchott. This activity will serve two functions:
  - Familiarizing all parties involved with the technology. For this purpose, the site will need to be adequately visible. It is important to ensure the visibility of, and publicity for, the project from the outset. A number of decision-makers will thus have seen a wind turbine personally and will know—at least to some extent—what this project is about.
  - Quickly establishing an effective technical collaboration with the University of Mauritania which will be expanded to other project activities such as the field surveys. The presence of wind turbines is a concrete mobilizing factor.
- 1.4.2 For each specific wind energy application, criteria will be developed and used to determine the best village sites.
- 1.4.3 The initial installations will be used to identify a variety of financial mechanisms that can ensure some degree of cost recovery. A special contract will be considered, since the initial installations will be experimental, and there is no financial mechanism yet in place to permit cost recovery. Another important use of this test phase will be to determine the financial capacity of the various end-users. For this reason, the project will define mechanisms similar to those to be used during Phase 2 for cost recovery.
- 1.4.4 To understand the installation conditions and requirements for the test equipment, the project will work to locate volunteers for the initial test installations. The initial requests will therefore be made by the villages, and the project will then assess the technical conditions of a number of potential sites prior to final selection.
- 1.4.5 The project will solicit and evaluate requests from individual communities as well as from individuals, NGOs, agencies, companies, and others. These requests will be evaluated by the project team, and any applications that support the goals of the project will be explored.
- 1.4.6 Through a number of meetings with villages that have indicated their interest during the regional study of need, or following the announcement, villages will be selected for the initial

test and demonstration installations. Each community or operator will have been informed of, and agreed to, the financial requirements for participating in, and benefitting from, these tests. The definitive list of beneficiaries will be determined in consultation with the Coordination Committee.

The choice of equipment for installation will depend on the specific sites and applications chosen. The project resources will permit installation of two types of wind electric units, together with associated end-use appliances and other equipment: approximately fifteen wind turbines in the range of 500 We to 2 kWe, and approximately forty small wind turbines rated below 100 We.

The specific number of sites has not been precisely determined. Some sites will be equipped with several wind electric systems, the objective being to respond to an array of specific needs (for example, water pumping, lighting, shaft energy and support of dispensaries) and to have a strong demonstration effect rather than just expand the number of sites to as many as possible. In accordance with the needs and in the interest of project economics, initial sites will be selected that permit concentration of installations.

It is clear that the small wind turbines will be used primarily for individual lighting and television. A group of these turbines will be installed at a few sites only.

- 1.4.7 The project support team, in collaboration with the suppliers of the wind electric equipment, will determine the size and configuration of the systems to be installed, including the wind turbine and all intermediary and end-use equipment.

The orders for the systems will be grouped as the project support team and the supplier come to an agreement on the choice of equipment.

- 1.4.8 The twenty or so initial installations will be carried out over a six month period by the selected enterprise under the supervision of the project team. The financial and contractual terms will be established with the local communities, and technical support will be provided to the local enterprise (see below).

#### Activities, responsibilities and support for Output 1.4

|       | <i>Activities</i>  | <i>Responsibility</i> | <i>Support</i>             |
|-------|--|-----------------------|----------------------------|
| 1.4.1 | Initial installation of wind electric units at experimental sites                    | CNEA                  | Expert for experimentation |
| 1.4.2 | Establishment of criteria for selection of test sites for each principal application | GRET project team     | GRET/EER support team      |

|       |   |   |                              |
|-------|---|---|------------------------------|
| 1.4.3 | Determination of financial conditions for equipment transfer during initial phase | GRET project team<br>Coordination Committee | GRET/EER support team<br>IDM |
| 1.4.4 | Publication of the criteria and conditions in the pilot zone                      | GRET project team                           |                              |
| 1.4.5 | Receipt of requests from villages or individuals                                  | GRET project team                           |                              |
| 1.4.6 | Identification of test sites  | GRET project team                           | GRET support team            |
| 1.4.7 | Choice and ordering of the systems  | GRET project team<br>GRET/EER support team  | Wind energy expert 1         |
| 1.4.8 | Installation of demonstration equipment at test sites                             | GRET project team<br>Local enterprise       | GRET/EER support team        |

### Output 1.5

Technical and socioeconomic evaluation will be conducted in both phases of the test systems after their operation under representative field conditions. This output is to be obtained by the end of Phases 1 and 2.

#### Activities for Output 1.5 (Phase 1)

1.5.1 The data likely to be obtained as a result of the experimentation will need to be determined. Foreseeable measures include:

- Technical data: power generation and power consumption with daily and seasonal variations, system efficiency, component behavior, and quality of service
- Economic data: operating costs, cost of energy generated, needs met, comparison with prior situation, and other competing energy sources.

The methodology to be applied for data gathering (monitoring sheets, frequency of field collection, and so on) will then have to be determined.

1.5.2 Monitoring and technical evaluation, including periodic on-site visits, daily data gathering from readings taken from recording instruments by a person permanently assigned to the site, identifying technical difficulties encountered, and resulting changes introduced in the installation.

The technical monitoring will be performed, in addition to the regular ongoing monitoring by the project team, during the second and third visits of the technical trainer. The training sessions will focus on assessing the wind electric equipment performances, and determining changes to be introduced.

The socioeconomic monitoring will be performed by the GRET project team and expert during the monitoring missions conducted by GRET. IDM and its subsidiaries (Compta Conseil) will also provide close support to private individuals using wind energy for commercial activities. This monitoring will be implemented according to usual IDM procedures and will produce, in addition to the specific operator training which is its main objective, a set of very precise economic and financial data.

A final assessment of both the technical and economic aspects will be performed by two designated consultants at the end of Phase 1, by which time the installations will have been in operation for nine months to a year.

- 1.5.3 Economic and financial assessment of the wind turbine costs and benefits will be conducted, together with an assessment of the effectiveness of management methods used in the project. The socioeconomic impact on each community equipped with one or more wind electric installation, will also be evaluated over time, beginning with a baseline assessment prior to the installation of any equipment. The monitoring activities will extend over a minimum nine-month period, or longer for those systems which were installed first.

The monitoring will be conducted by the project team with the assistance of two socioeconomic missions. Another mission at the end of the initial test period will evaluate the impact of the systems, and draw the main conclusions.

- 1.5.4 Technical and economic data sheets will be prepared summarizing the results collected during the test phase. These data sheets are meant for a limited audience. If a wider dissemination is warranted, they will be communicated to any interested party, more particularly, developers and prospective buyers. Each data sheet will present complete information pertaining to expected performances and costs, based on actual measurements taken on the test systems.
- 1.5.5 To catalyze and support the diffusion of small wind turbines and associated equipment in Mauritania, at least one national information seminar will be held in Nouakchott for all entities and individuals active in rural development in Mauritania. It will also be open to foreign participants. This seminar will prepare Phase 2, the distribution phase, of the project.

#### Activities for Output 1.5 (Phase 2)

During Phase 2, the number of electric systems will be considerably greater (approximately 100 sites). Monitoring of installations will remain one of the project's activities, although not as closely as during Phase 1. The two monitoring functions will be as follows:

- *User training function.* For typically commercial activities, IDM and its managers will still be called upon to perform monthly, then quarterly, then semi-annual visits, according to the degree of autonomy of the economic operators concerned. For all sites, training will be done first through basic seminars focusing on the main problems encountered (such as technical, management, accounting, or energy distribution problems). Periodic on-site visits will continue in order to provide advice and on-the-job training.
- *Data gathering function.* Data which may be collected during visits by the project team and IDM will not be sufficient. Test sites will need to be set up to collect all usage data necessary for an analysis of the installation operation. Inquiries will also be conducted to outline the positive aspects and the problems encountered by the various project participants (users, enterprises, and others). This monitoring activity will be implemented jointly with the School of Economic Sciences of the University of Nouakchott.

Monitoring will also be performed by a yearly assessment mission conducted by a socio-economist.

#### Activities, responsibilities and support for Output 1.5

|       | <i>Activities</i>                       | <i>Responsibility</i>                         | <i>Support</i>            |
|-------|---|---|---------------------------|
| 1.5.1 | Designing monitoring tools              | GRET project team                             | GRET/EER support team     |
| 1.5.2 | Monitoring and technical evaluation     | GRET project team<br>Final evaluation mission | Technical training expert |
| 1.5.3 | Monitoring and socioeconomic evaluation | GRET project team                             | GRET support team<br>IDM  |
| 1.5.4 | Drafting information data sheets        | GRET project team                             | GRET/EER support team     |
| 1.5.5 | National information seminar            | GRET project team                             | GRET/EER support team     |

#### Output 1.6

Testing, application, and assessment of several wind electric systems, and development of the technical adaptations that may be required for reliable operation in Mauritania. This output is to be obtained by the end of Phases 1 and 2.

While the equipment used is industrial equipment and the technology risk may be limited by selecting proven equipment, there is a need to include an experimental component in the project for the following reasons:

- Not all wind energy technologies to be diffused in Mauritania are used for the projected applications. Therefore, some will be prototypes (for example, food product conservation, desalination of seawater, or ice making). It would be preferable for these entirely new applications to conduct an initial experimental phase in the laboratory prior to field installation.
- It will be necessary to optimize the general efficiency of the installations in order to control the cost of the service provided. If the gain is to be less than 10 percent, there will be no need to intervene; however, much higher efficiency gains may be achieved (up to 30 percent).
- Finally, numerous practical problems of a technical nature may be anticipated. This possibility will require introducing changes in the systems and testing some of the technical elements prior to their field application. Certain specific systems for electricity supply, distribution, and metering will also be tested.

#### Activities for Output 1.6 (Phase 1)

- 1.6.1 There will be two experimental sites. One test facility is already installed and operating in Moules (France), for which EER and GRET are responsible. The site is located on land belonging to Lyonnaise des Eaux-Dumez, a major company that will provide grant support for the project experimentation activities. A second test facility will be installed jointly in Nouakchott by CNEA/Department of Energy and the University of Nouakchott (CSET and ISS), in conjunction with a French university. The French cooperation authorities are setting up the modalities of this joint effort. The role of the University/CNEA group will be to form a wind energy centre, to conduct its own scientific activities, and to coordinate with all ongoing activities in the wind energy sector in Western Africa. Project Alizés/é will participate actively in the development of the wind energy centre in Nouakchott.

As requested by the government, the French experts at Moules will provide assistance for installation at the Nouakchott site so that it will be fully operational and self-sufficient by the end of Phase 1, at the latest. Extensive training of the Department of Energy engineers will be provided to meet this goal (2 m/m per year).

Both experimentation sites will work closely in a complementary fashion. They will define a joint work programme, and produce joint publications. A specific six-month test protocol for both experimentation sites will be signed by GRET and the government. Only those tests that cannot be conducted in Nouakchott will be performed at Moules, with project financing.

Installation of the first experimental wind turbines will be implemented as soon as possible, within the first months of the project, in order to make the wind turbines visible in the city of Nouakchott. The wind turbines tested in France will then be shipped to Nouakchott.

1.6.2 Initially, joint experimentation protocols will be defined. They will be updated and adapted later as needed.

1.6.3 Several small wind turbines (up to about 10 kWe of rated capacity) of different brands will be installed at the Nouakchott site for demonstration and test purposes. More specifically, should major problems arise with the model selected in Phase 1, a replacement could be suggested for Phase 2. It is recommended, however, to begin with the equipment selected to be installed in the villages, and only then to experiment with other equipment. This experimentation with various types of wind turbines will allow a technical comparison of the different models.

1.6.4 Experiments with systems to associate equipment will be conducted at both sites in a complementary fashion. The selection of the equipment to be tested will be based on market demand, and will therefore only be known after the market study. The purpose of this experimentation is to suggest improved systems as compared to those that might be installed based solely on the technical documentation. The experimentation will be conducted along the following lines and based on the following criteria:

- Selection of the equipment constituting the system, optimizing the efficiency and cost. The manufacturers' documentation is often overly optimistic and sometimes lacking in accurate data as the systems are generally designed for applications where energy is abundant. The specifications should be carefully checked, and the equipment selected by comparing their differences, keeping in mind their cost-efficiency ratio.
- Selection of the equipment for a better general system integration, taking into account the type of technology, cost of equipment, efficiency, compatibility between the various items of equipment, and general system optimization.
- Testing ease of use: size, type of connection, maintenance expenses, ease of installation, storage, impact resistance, sand resistance, and other aspects.
- Care must be taken to ensure harmonization and standardization of the equipment between the various technology applications. Each application should not be a totally specific application, and a broad interaction should be possible between the various pieces of equipment, thus allowing considerable cost reduction in Mauritania. The equipment should be selected both in view of its own application, and of the other applications, so as to reduce the number of individual cases.

Equipment standardization will result in expanding the wind turbine market and reducing prices.

Neighboring countries using similar equipment (for example, Morocco and Senegal) should also be consulted in order to expand the standardization field, and to benefit from local production activities already underway.

1.6.5 It is necessary to improve on the solutions suggested in order to ensure closer adherence to

the above-mentioned criteria. New products need to be tested, and if the test results so warrant, these products may be installed in the field. A few examples illustrate this point:

- It would be beneficial to begin working immediately to optimize the pump-wind turbine system (an adaptation of the solar pump variable frequency inverter). The present PV inverter is not satisfactory in that it requires a startup current higher than the operating current—a problem for wind turbines which experience wide operating fluctuations. The added power required also doubles the cost of the inverter. A different technology exists, but it must be adapted to the wind turbines under consideration.
- As regards pumping, rather than use AC solutions, it could be interesting to examine the applications of DC pumps, such as piston pumps of the UPM type.
- Regarding the choice of batteries, the batteries manufactured in Senegal will need to be tested. An environmental impact assessment of the batteries will also be useful, and a recovery system will need to be designed.
- To charge the batteries, simple, very cheap discharge regulators are needed, integrated in a single housing with the battery and standard outlets.

Numerous other technical applications may be mentioned. Using batteries is the safest but also the most expensive one, as part of the energy is lost, and batteries are an important maintenance item. Testing the equipment must therefore be applied to solutions making greater use of direct uses, as well as to those avoiding AC.

Finally, equipment using DC and AC, and allowing pre-payment (pre-payment meters (South Africa) pay meters (Total France)) should also be tested.

- 1.6.6 The technical monitoring will definitely require technical modifications, either to remedy excessive breakdowns in the equipment, or to implement electronic adjustments in order to facilitate their use or management.

The wind turbines must be adapted to the conditions existing in Mauritania. For instance, Project Alizés technicians realized that minor modifications on the mechanical braking system of the LMW 1003 wind turbine were required in order to benefit from adjustments already made for this type of braking on the Oasis models.

- 1.6.7 The number of technical applications will be greater during Phase 2. It will be useful during Phase 1 to determine a number of specific technical applications which will be offered for diffusion during Phase 2.

#### Activities for Output 1.6 (Phase 2)

The testing activities will continue during Phase 2. It is important that the CNEA/University consortium pursue its work. Not all solutions will be satisfactory, and technical assistance



will be needed in order to adapt the equipment to actual needs and field conditions. The purpose is not to develop what is already in existence and working. Information should be gathered during Phase 1 on equipment already existing in other parts of the world (for example, small wind turbines in Mongolia, and water pumping applications in Texas).

#### **Activities, responsibilities and support for Output 1.6**

|       | <i>Activities</i>  | <i>Responsibility</i>             | <i>Support</i>                                       |
|-------|--|-----------------------------------|--|
| 1.6.1 | Installation of experimentation sites                        | CNEA/DE<br>Experimentation expert | University<br>GRET project team                      |
| 1.6.2 | Definition of experimentation protocols                      | CNEA/DE<br>Experimentation expert | University   |
| 1.6.3 | Experimentation with various wind turbines                   | CNEA/DE<br>Experimentation expert | University   |
| 1.6.4 | Experimentation with systems: associating equipment          | CNEA/DE<br>Experimentation expert | University<br>GRET support team<br>GRET project team |
| 1.6.5 | Experimentation with new equipment                           | CNEA/DE<br>Experimentation expert | University<br>GRET project team                      |
| 1.6.6 | Adaptation and modification studies                          | CNEA/DE<br>Experimentation expert | University<br>GRET project team                      |
| 1.6.7 | Experimentation with technical solutions for later diffusion | CNEA/DE<br>Experimentation expert | University<br>GRET support team                      |

## **IMMEDIATE OBJECTIVE 2**

Establish a replicable technical, financial, and institutional mechanism, under local control, for the diffusion of technologies using renewable energy, primarily wind power turbines, to permit the development of rural pre-electrification in Mauritania.

### **Output 2.1**

The project will have realized the training of one or more local enterprises for assembly, manufacture (of some components), installation, and maintenance of wind electric units, and establishment of contracts for services of these enterprises. This output is to be obtained by the end of Phases 1 and 2.

## Activities for Output 2.1 (Phase 1)

- 2.1.1 Two collaboration arrangements will be established: between the equipment supplier and the local Mauritanian enterprise(s); and between the project and the local enterprises. Each will be formalized through suitable contracts. The contracts will be established for the initial phase of the project, with provisions for a short trial period.

The project will guarantee an initial market to the local enterprise, and will assist in matters of training, preferential credit, and institutional issues and mechanisms. This ensemble of supporting activities constitutes an important in-kind support, and will be linked to a number of conditions, in particular, the local enterprise will agree on the provision of quality service, delivery schedules and prices. It will also agree to accounting and management audits, and will undertake to abide by the recommendations made as a result of these audits.

In order to exercise control over the enterprise for the entire duration of the project, a project NGO will acquire a temporary interest in the enterprise. In view of its experience with these mechanisms and familiarity with Mauritanian enterprises, IDM, the SIDI subsidiary in Mauritania, will assume this role in keeping with the usual procedures.

- 2.1.2 The local enterprise will receive substantial training. This training constitutes an important investment which is justified in view of the substantial demands that the project will make on local enterprises. The supplier, in return for the opportunity to introduce its products and penetrate the Mauritanian and African markets, will participate in the training of the technicians from the Mauritanian enterprises. Training and related activities will include the following:

- Training of a technician at the facilities of the supplier prior to the first installations.
- Visits to the headquarters of the selected supplier and in other foreign countries by the director of the selected Mauritanian enterprise in order to establish suitable commercial relationships.
- Training of technicians from the local enterprise by expert technical missions in the areas of fabrication and maintenance of wind electric systems, and associated end-use equipment. During Phase 1, it is anticipated that there will be three expert missions to Mauritania to conduct such training. At least one mission to Mauritania by a technician from the supplier will also be necessary to strengthen the local enterprise production capabilities.

The partial fabrication locally of wind turbine equipment is an objective of Phase 1. The components which ought to be amenable to local fabrication include the following:

- The towers for each type of wind turbine
- Some mechanical components, such as wind vanes and top sections
- The housings for the control system
- Some electrical and electronic components, such as the battery charge controllers.

The opportunity for local fabrication of system components will be an important value-added activity for the local enterprise, and will increase its interest in getting into the wind electric product business. These incentives will help transform what might be only an import activity into a local industry, radically modifying the nature of the enterprise's involvement. It is therefore important to obtain local involvement from the very beginning of the project. Local manufacturing will also result in a substantial reduction in the cost of the equipment installed in Mauritania, and provide an opportunity to test the capabilities of the local enterprise.

2.1.3 The enterprises connected with project activities may be able to pay for their own development. In this case, no financial assistance will be provided. The most probable scenario, however, is that they will require financial support (equipment, training, stocking, and other means), in which case the project will establish a two-fold support mechanism:

- Conditional acquisition of participation interest for the purpose of covering the costs of the reconversion, or investment of the enterprise in the new domain of wind electric power
- Provision of credit to local enterprises, which can be efficiently done by IDM and SIDI (as capital contribution and/or loan), and/or by known state entities (banks, industrial fund) providing support funds at concessional rates.

No provision was made in the project budget for funding this financial support. Funding will come either from SIDI if it is provided through a capital contribution, or from already existing budget lines in Mauritania if it is provided through a loan (for example, in collaboration with the CFD).

2.1.4 Assistance by IDM to local enterprises will include internal training, assistance in organization, industrial production, technology evaluation, and management. IDM will implement a mechanism to support the development of enterprises based on added value, efficient organization, and careful management.

Local technical assistance and support will complement the transfer of technology and the technical training provided by short-term expert consultants. The costs of local technical support will initially be supported by the project, but will gradually be shared with the local enterprise(s).

2.1.5 From the start of the project, an important goal is to assist the local enterprises in developing commercial activities that will extend well beyond the life of the project. For this purpose, it is necessary that the enterprise enter into contracts with its clients, and that the project be as invisible as possible.

#### Activities for Output 2.1 (Phase 2)

In Phase 2, the same financial assistance and management support activities will continue. The goal is to assist the local enterprises in gradually reducing their dependence on this assistance. The enterprises should eventually operate with only occasional support and

backstopping by IDM and other organizations to ensure good management and accounting practices for the entire duration of the project and beyond.

### Activities, responsibilities and support for Output 2.1

|       | <i>Activities</i>  | <i>Responsibility</i>     | <i>Support</i>                         |
|-------|--|---------------------------|--|
| 2.1.1 | Establishment of collaborations  | GRET project team         | IDM<br>GRET support team               |
| 2.1.2 | Local enterprise technical training  | Technical training expert | Supplier<br>GRET project team          |
| 2.1.3 | Financial assistance   | IDM                       | GRET project team                      |
| 2.1.4 | Management monitoring and support  | IDM                       | GRET project team<br>GRET support team |
| 2.1.5 | Establishment of commercial relations between the enterprise and the end-users | GRET project team         | GRET support team                      |

### Output 2.2

Establishment of a mechanism for electrification in rural areas. This objective will be achieved through financial means allowing purchases of decentralized power systems, and through direct supply of electricity with some form of payment according to the consumption. This output is to be obtained by the end of Phase 2.

This mechanism can be for the supply of electricity or water. It will aim primarily at spreading out payments by the users for installation, maintenance, and repair of wind electric systems, and associated applications (pumping, lighting, refrigeration, and others). It could consist of one or more of the following:

- A private or semi-public enterprise for the provision of rural pre-electrification services. The enterprise could: own the equipment and make it available to the end-users while providing maintenance, and selling the electricity generated; offer a leasing contract and provide maintenance according to the contract; or sell the equipment outright, while providing a warranty and a maintenance contract.
- A financial credit mechanism, both for the rural pre-electrification enterprise and other creditworthy owners or users (village cooperatives, small industries, or NGOs such as World Vision or Oxfam ).
- A leasing company.

## Activities for Output 2.2 (Phase 1)

2.2.1 The project aims at setting up a durable, replicable system which requires operating on a true cost basis. However, a subsidy element will be introduced at the sales price level. This procedure will be accomplished by applying two principles:

- The subsidy will serve to cover the additional costs incurred during the initial phase of introduction of the equipment in Mauritania. The enterprise has not yet optimized its costs nor its services, and the mass effect does not allow for substantial economies of scale.
- The subsidy should place the costs at those levels that will be maintained in the diffusion phase.

The following policy will therefore be implemented:

- Equipment for economic or personal use: a small subsidy will offset the lack of cost optimization at the enterprise level, due to the introduction of the equipment in Mauritania.
- Equipment for social applications: the community will receive an additional subsidy. External financing is expected to be made available in a later phase for community applications, such as village water systems and health. A durable system therefore does not imply 100 percent cost recovery.

The amount of the subsidy will be determined during the preparation of the pilot installations, after studying the market and the technologies.

### **Types of subventions**

|                    | Social applications | Economic applications | Individual applications |
|--------------------|---------------------|-----------------------|-------------------------|
| Start-up (phase 1) | 20%                 | 20%                   | 20%                     |
| Start-up (phase 2) | 10%                 | 10%                   | 10%                     |
| Social nature      | 30%                 | -                     | -                       |
| Total (phase 1)    | 50%                 | 20%                   | 20%                     |
| Total (phase 2)    | 40%                 | 10%                   | 10%                     |
| Post-project       | 30%                 | -                     | -                       |

2.2.2 For the first installations (very likely all of Phase 1), the project will have to substitute for the financial mechanism to be established later. It is important, however, to apply during Phase 1 a method consistent with that of Phase 2. It will also be useful to test acceptance by users of the various solutions.

The project team will define a set of guidelines for obtaining financial participation from the users in the investment, maintenance, and replacement of the equipment. The solutions may range from the sale of the service (for example, per kilowatt hour (kWh)) to a periodic contribution, and from an initial capital investment to installment payments. Attempts will also be made to set up, jointly with the interested parties, a practical system for the collection of individual payments (such as payment by tokens as in Project Alizés).

- 2.2.3 A series of socioeconomic studies will assess the choices made by the individuals and the communities, and the social and economic impact of the various solutions selected.
- 2.2.4 A task force will be created in order to study the interest and feasibility of various types of mechanisms for the diffusion of the equipment. This task force will be led by IDM and will comprise: SONELEC, the Department of Energy, IDM, GRET, private suppliers of equipment, and any partner whose input may be useful for this purpose (more particularly a representative of the banking sector and CFD).

Various structures and mechanisms may be considered including:

- A company specializing in rural pre-electrification. It is a known fact, based on past experience in other countries (such as Morocco and Indonesia), that a specialized structure is needed for purposes of financing the distribution of wind electric equipment. This structure could be a new business corporation created specifically to meet the need, with such shareholders as:
  - The Mauritanian private corporations involved in Project Alizés (Deyloul, SOMER—BIT)
  - The National Electricity Company (SONELEC)
  - The NGOs active in Mauritania (IDM, EER, CARITAS, GRET).

In order to be efficient, the structure will require no supervision and be entirely independent, with limited staff (two or three persons). If newly created, it may be located in GRET installations in order to limit the operating costs, and to make cooperation with GRET more rational and coherent.

The purpose of this structure will be primarily the distribution of the wind electric equipment and the collection of the users charges.

- A standard credit mechanism for the purchase of the wind turbines will also be required. The loans may be extended through the specialized structure, or through other structures already existing independently from the project (for example, IDM or the Délégation générale à l'insertion), or through other structures to be created. The maximum duration of the investment credit granted to the various beneficiaries (social, commercial or individual use) will be five years.

- The third financing mechanism is based on the leasing principle, which is more suited to the rural sector and does not conflict with religious principles. Jointly with the distribution structure, this financing structure could set up three types of lease financing plans according to the buyer (village community, social or commercial group, promoters, individuals):
- The so-called TAJIR operations, or capital goods financing amortized over several years with the interest margin included in the cost (manufacturer's costs + expenses + interest = cost of the equipment financed)
- The so-called MOUDHARA operations, or financing through association of the capital invested and the value of the work performed by the beneficiary to implement the project, with profit sharing prorated according to the contributions of each party
- Modern leasing operations by providing the wind electric equipment under a simple renting agreement with the option to buy at the end of the amortization period.

These three types of operations may be appropriate for local communities, village cooperatives, promoters or individuals. They may also be part of sales or financing agreements with NGOs or other institutions managing lines of credit, with provisions for retaining ownership of the equipment until full payment is made.

- In the financial mechanisms described above, the return on the investment provided by the project should theoretically occur at the end of the first five-year period. The return on investment will not exceed 50 percent of the initial financing due to the installation programming, in other words, approximately 20 percent during the test period (2 years), 50 to 60 percent during the next two years, 20 to 30 percent during the fifth year, and an estimated 20 percent outstanding.

Allocation of the return on investment needs to be decided before startup on the first installations. The choice is as follows:

- *Reinvestment.* This first scenario ultimately allows an increase of the number of wind turbines initially considered, with the added advantage that wind turbines can then be installed in other areas not covered by the project, thus anticipating the popularization of wind turbines in Mauritania.
- *Earmarking.* This second scenario consists in allocating the return on investment to a blocked account bearing interest for the entire duration of the project (five years). The resulting capital and accrued interest are allocated either to ensure the durability of the wind turbine installations in Mauritania after the project has ended, or transferred to the initially created distribution structure (subsidized funding), or to a State entity (such as SONELEC). This last option would concern not only the return on investment, but also the wind turbine distribution and diffusion structure.

- 2.2.5 As a result of its activities, the task force will submit very specific solutions indicating the choice of partners, the exact amounts to be financed, and the partnerships established.
- 2.2.6 The proposals will be reviewed by several financial and socioeconomic experts, more particularly by present and future donors. These entities will submit their opinions individually. The project team will then collect them, and a broader coordination committee including the task force will decide on the final proposal for the mechanism to be made operational for Phase 2. This final proposal will be submitted for approval to the Steering Committee.
- 2.2.7 The specialized structure(s) and mechanisms will be put into place at the end of Phase 1. They will become operational during Phase 2 which will serve to validate them.

**Activities for Output 2.2 (Phase 2)**

- 2.2.8 All Phase 2 installations will be made using the financial diffusion system. This process will be completed within the standard framework of the diffusion phase, where the project no longer intervenes directly, and where the project team simply performs monitoring and analysis functions.
- 2.2.9 Over the entire second phase, there will be ongoing monitoring and detailed yearly assessments in order to analyze the viability, usefulness, and efficiency of the system. Readjustments will be made as needed. This process is a dynamic one, aimed at establishing a reliable, efficient system by the end of Phase 2.

**Activities, responsibilities and support for Output 2.2**

|       | <i>Activities</i>  | <i>Responsibility</i>                       | <i>Support</i>                         |
|-------|--|---|--|
| 2.2.1 | Designing the implementation of a cost recovery policy                     | GRET project team<br>Coordination Committee | GRET support team<br>IDM               |
| 2.2.2 | Implementation of first experimental solutions                             | GRET project team                           | GRET support team                      |
| 2.2.3 | Assessment of experimental solutions impact                                | GRET project team<br>Final assessment team  | GRET support team<br>IDM               |
| 2.2.4 | Designing appropriate mechanisms for cost recovery and search for partners | IDM and task force                          | GRET project team<br>GRET support team |
| 2.2.5 | Submission of proposals  | IDM   | GRET project team                      |



|       |   |                            |   |
|-------|---|----------------------------|---|
| 2.2.6 | Review of the proposals                         | Coordination Committee     | Associated experts<br>Donors<br>GRET support team<br>GRET project team<br>IDM |
| 2.2.7 | Establishing the financial system               | GRET project team          | IDM   |
| 2.2.8 | Operation of the financial system for diffusion | Ad hoc financial structure | GRET project team<br>IDM  |
| 2.2.9 | Monitoring and assessment                       |                            |   |

### **Output 2.3**

Training and establishment of a national capacity in Mauritania. Several Mauritanian engineers and technicians for the public and private sectors will be trained by the project. This output is to be obtained by the end of Phases 1 and 2.

#### **Activities for Output 2.3 (Phases 1 and 2)**

- 2.3.1 The implementation of the project will constitute a highly efficient training, based on practical experience, for several managers, technicians and outreach workers. By the end of the project, they will have acquired the experience necessary to enable them to duplicate the project or to undertake similar ones.
- The personnel to be trained will be the engineers involved in the implementation of the project: the technician seconded to GRET by the Department of Energy, and the CNEA/DE engineers in charge of the monitoring and ancillary tasks. The outreach workers employed by the project and the technicians from private enterprises selected for the supply and maintenance of the equipment will also be trained.
- 2.3.2 The individuals mentioned above will receive training from experts on mission in Mauritania whose specific task will be to train them (as in the case of the supplier or the technical trainer or the experimentation manager in France), or to link them with their own work. Project workshops and publications will also contribute to the training.
- 2.3.3 The project team will conduct visits to similar projects or will participate in meetings organized abroad including:
- In Morocco, the CFD rural electrification project, the German Technical Cooperation Agency (GTZ) project for the diffusion of PV kits, and wind-energy projects (Bergey wind turbines)

- In Senegal, the GTZ project for the diffusion of PV kits
- In Cape Verde, visit wind energy installations
- In Tunisia, visit wind energy programmes
- In the Sahel, participation in the meetings for the assessment of the RSP
- In France and the United States, participation in international seminars
- In Mali, the Aqua Viva solar energy pumping project (including analysis of the few Aéro watt wind turbines), and other solar energy projects.

One technician from the local enterprise will also receive training at the site of the supplier. The manager of the enterprise will conduct a public relations mission to Europe in order to establish the necessary business contacts (see Activity 1.5.2).

- 2.3.4 The numerous contacts made by the project team and the support team will result in the creation of an informal network on such specific themes as pre-electrification, wind energy, and renewable energies. The summary data sheets and public reports will be distributed to all network members. Conversely, efforts will be made to obtain information on the activities conducted by other network members.

#### **Activities, responsibilities and support for Output 2.3**

|       | <i>Activities</i>            | <i>Responsibility</i>     | <i>Support</i>   |
|-------|------------------------------|---------------------------|--|
| 2.3.1 | Participation in the project | GRET project team<br>CNEA | GRET support team  |
| 2.3.2 | In-country training          | Experts on missions       |  |
| 2.3.3 | Out-of-country training      | GRET project team         | GRET support team<br>Teams from the various projects visited |
| 2.3.4 | Networking                   | GRET project team         | GRET support team<br>Experts involved in the project         |

### **IMMEDIATE OBJECTIVE 3**

Equip 100 villages with various types of systems for various applications using electric power generation through wind energy.

#### **Output 3.1**

Approximately 100 villages will be equipped with wind electric systems for various types of use aimed at social and economic development. This output is to be obtained at the end of

Phase 2. These installations will be of two types: social applications (drinking water, health, and others), and commercial or individual applications.

Phase 1 of the project is a development phase; diffusion will take place in Phase 2. More precisely, Phase 2 will be a pre-diffusion phase, as its purpose will be the large-scale validation of the technical and financial diffusion mechanisms, and to confirm the socioeconomic value of the wind turbines. Phase 2 will be defined in greater detail after Phase 1 has been evaluated.

These installations in 100 villages are a strategic objective. Only at the end of Phase 1 will it be possible to determine whether the costs for these installations and the required amount of work can be fully assumed by Phase 2 donors.

The activities undertaken during Phase 2 (see below) will be defined in greater detail upon the evaluation of Phase 1.

### Activities for Output 3.1 (Phase 1)

3.1.1 Evaluation of the technical and financial mechanisms proposed during the preliminary phase and further definition of the pre-diffusion activities. The pre-diffusion phase will be launched only after a positive evaluation of the first demonstration systems installed during Phase 1. This evaluation will take into account:

- The service rendered by the air turbine to meet economic or social needs
- The economic efficiency of the installation
- The technical reliability
- The operability of the financial support system for the diffusion of the equipment
- The interest and political will of the public authorities
- The reliability of the Mauritanian enterprises for the supply and maintenance of the air turbines and associated equipment.

This evaluation will be external. It will also analyze the proposals submitted by the NGO and the government regarding the implementation of the pre-diffusion phase.

3.1.2 The optional choice of one or two diffusion areas made at the onset of the programme will be reviewed. More particularly, a choice will have to be made as to whether the project will be developed in the Adrar area or not. A new market study will be conducted, based on field data and integrating the new solutions suggested by the support team for Phase 2. This study will be optional, focusing on the areas where additional data is needed.

The choice concerning the concentration will be suggested by the team and submitted to the Steering Committee for review and final decision.

### Activities for Output 3.1 (Phase 2)

- 3.1.3 The project approach will be responsive to requests for systems. This activity will be done by means of a clear announcement of the technical specifications and financing terms published in the selected regions. These announcements will be made in workshops, video-tapes, articles in the print media, and presentation packages. The project will then respond to the requests submitted, based on the chronological order of receipt of payments.
- 3.1.4 Private operators and financing mechanisms will be called upon to install and finance the wind electric systems. The users will deal directly with them, as in the case of a standard non-project distribution arrangement.
- 3.1.5 Equipment performance will be closely monitored. Modifications will be made as dictated by such problems as may be encountered. Economic performance will also be monitored to evaluate the cost-effectiveness of the equipment, or to set up operating modes aimed at improving the cost-effectiveness (see Activity 3.2.8).
- 3.1.6 The support team in charge of testing will be responsible for solving technical problems, and suggesting improvements when requested by the executing team.
- 3.1.7 The mechanism for diffusion allowing payment by installments will be closely monitored and modified as needed. The viability of this mechanism will actually constitute the main project output, and pre-diffusion Phase 2 is aimed primarily at validating this objective.

Particular attention will be paid to the following:

- Users payments: how regular are they, and are they difficult? Is collection well-organized at the user level?
  - Funds recovery: how efficient is collection? How much does it cost? Are there ways of improving funds recovery?
  - Management of recovered monies: what becomes of the recovered funds? How are they invested? How are they managed?
  - Structure: are the structures adequate as organized? Are their costs acceptable? Are the persons in charge performing their functions?
- 3.1.8 In addition to the regular monitoring and evaluation by the project team and by individual missions, an external evaluation will be performed at mid-point through Phase 2 in order to validate the measures implemented, and to modify them as needed.

### Activities, responsibilities and support for Output 3.1

|       | <i>Activities</i>   | <i>Responsibility</i>                         | <i>Support</i>                                 |
|-------|---|---|--|
| 3.1.1 | Evaluation of the technical and financial mechanisms proposed during the preliminary phase and further definition of the pre-diffusion activities | GRET project team<br>Final evaluation mission | IDM<br>GRET support team                       |
| 3.1.2 | Additional market study and choice of a concentration area  | GRET project team<br>Coordination Committee   | GRET support team                              |
| 3.1.3 | Publication and receipt of requests   | GRET project team                             | GRET support team                              |
| 3.1.4 | Installation of the wind electric systems   | GRET project team<br>Local enterprise         | GRET support team                              |
|       |   |   |  |
| 3.1.5 | Technical and socioeconomic monitoring  | GRET project team                             | GRET support team<br>IDM<br>Evaluation experts |
| 3.1.6 | Possible technical adaptations  | GRET support team<br>CNEA/DE                  | Experimentation experts<br>University          |
| 3.1.7 | Diffusion mechanism monitoring  | GRET project team<br>IDM                      | GRET support team                              |
| 3.1.8 | Evaluations   | GRET<br>Evaluation experts                    | GRET project team                              |

### Output 3.2

Building the capacities of end-users for group or individual management and simple maintenance of the energy equipment. This output will be obtained by the end of Phases 1 and 2.

While the success of the project requires technical systems suited to the task, technical capabilities of the private enterprises involved, and a financial mechanism for the diffusion phase, a fourth essential component is the ability of the end-users to manage and maintain

the systems. The project will therefore have to provide information and training to the local population in order to ensure efficient control and use of the equipment. Sociologists will be called upon to support the project team in this area.

#### Activities for Output 3.2 (Phase 1)

- 3.2.1 An overall analysis will be conducted within the market study (Activities 1.1.1 and 1.1.4). Upon review of the requests for site selection, a detailed socioeconomic analysis of the groups requesting installation will be performed.

#### Activities for Output 3.2 (Phases 1 and 2)

- 3.2.2 The site selection method is a crucial element determining the success of any rural improvement operation. Only the equipment requested and wanted by the beneficiaries will have a chance of working well and for a long time. The equipment must meet the technical, psychological, economic, and social expectations of the people.

Prior site study, however well conducted, is entirely insufficient. In particular, it affords no guarantee as to the motivation of the requesting party. One of the few effective ways of testing this motivation is to install the equipment only for those groups who actively seek to obtain it, through financial participation or labor contribution, for example. Financial participation is preferable in that it is also a test of the financial capabilities of the community. It is not recommended to place equipment in the hands of people without any financial income, as this is certain to cause future maintenance problems.

Once the initial needs have been identified, however, the project will promote the equipment, some of which will bring social benefits to disadvantaged population groups. Information activities and site selection methods will have to be participatory in nature and allow a diffusion of all technical applications selected. This work will be done with the help of expert sociologists.

- 3.2.3 Determination of the method to promote user participation and management. The type of management of the installations is linked to two determining elements:
- The types of villages and sub-groups concerned
  - The general diffusion mechanism for the wind turbines as described under Output 2.1.

There are various types of social organization of the communities. The villages may be based on the family, they may be modern, hierarchical, comprise several clans, or have other important characteristics. The system to be adopted for the management of the equipment will have to take these aspects into consideration.

An egalitarian, associative type of organization is well-suited for some larger villages with no marked hierarchy and numerous villagers working outside the village. In this case, payment according to consumption is an adequate method. The users will then be billed by

cubic metres of water or kWh of electricity, and the income can be managed collectively through some type of community association. At the other end of the spectrum, for smaller villages consisting of an extended family or a small mono-tribal group, or a brotherhood centred around its chief (or marabout), this type of organization would not work, because the chief is used to taking charge of all activities undertaken in the village. In cases between these two extremes, special structures will have to be put into place. In some villages, it will be preferable to rely as much as possible on individual services, and to limit the collective aspect to the general ownership of this daily management.

The project approach is not to impose any given type of organization, but to work together with the groups involved on the most appropriate type of organization for the group. These discussions must underline the social, economic, or technical implications of each solution. For example, paying for water by the cubic metre results in negating the traditional solidarity which exists between the rich and the poor, a fact which must be known before making the decision. Specific systems may be put into place to remedy this situation while still selling water by the cubic metre (for example, private subscriptions funding part of the costs).

The objective of these promotion activities is to set up a durable, efficient management system—one that gives access to the new service offered by the project to all. This goal requires that the group concerned assume ownership of the organizational system. It must therefore be defined jointly with the group, taking into account (generally) the existing social organizational principles.

Another element which will determine the type of communal organization is the general diffusion system. Two main types of diffusion may be envisioned (with a series of intermediate variants): the diffusion system may be merely a solution facilitating the purchase of the equipment which will then be owned by the beneficiary group who will therefore assume total management; or one may look at a private system of providing the service, in which the entire management part is assumed by a distribution entity dealing directly with the end-users, either groups or individuals. In this case, group management is much weaker than in the first case.

The degree of organization that will be required of the users remains unknown at this time. It is therefore more important to know what the project approach will be, rather than which specific solutions will be applied.

Within the initial two-year phase, however, it is unlikely that the final diffusion system will be in place, and a temporary solution will have to be developed. The project will then deal directly with the villages or sub-groups.

The method will be that of Project Alizés:

- Broad information on the population groups concerned is gathered.
- A socioeconomic study is performed when a request is made, in order to determine the general lines, and to acquire a good grasp of the situation.

- A review of the needs and request of the villagers (men and women), and joint discussions with them are held regarding management requirements: monitoring, service distribution, need to collect money, general participation in management activities, and other aspects.
- Time is left to the group to reflect upon the matters discussed during the meeting.
- A second meeting is held to analyze, put together, and amend, as needed, the results and conclusions of the previous meeting. This second meeting will conclude by the signature of a contract with the project for the acquisition and management of the equipment.

With this method, the final choices vary according to the village. In Project Alizés, there are now at least three main types of arrangements for the collection and management of the monies.

After the contract is signed, at least two follow-up visits are organized in order to examine the specific problems encountered jointly with the users. Specific training is also provided (on hygiene, as in Project Alizés, or on book keeping, or other topics).

- 3.2.4 The project team will provide the support within the parameters defined in Activity 3.2.2 for site selection and consciousness-raising activities to be implemented to support the requests submitted by interested groups. This support will consist specifically of informing the concerned villages, sub-groups, and individuals about the technical application suggested for the project, and studying with all interested parties how they should use the equipment in order to meet their needs. This process will be a first stage selection, as initial priority will be given to those who have expressed their interest.

The recommended approach for information and awareness activities is to avoid soliciting expressions of interest. The preferred method is to allow the group to decide freely to submit a request or to abstain. The project team can be involved in a proposal and help to analyze the needs and organizational methods. Upon completion of these information and awareness activities, the group must be left to its own devices, and must submit its request of its own accord. Both criteria are based on the motivation of the interested party. The first is to work with interested people (after providing general information to all), and the second is to leave the applicants free to submit their final request when they so desire. The final request results in the payment of their financial contribution.

- 3.2.5 As described under Activity 3.2.3, management systems will be suggested and discussed, but never imposed. Their implementation will require an information phase followed by a monitoring phase. It may be advantageous to involve SIDI by using the tools and skills already put into place (for example, Compta Conseil) for the organization and follow-up of the management mechanisms for activities involving an economic component or similar type.

The requirements for the project will be to empower the local operators entirely and promptly, to establish clear accounting procedures for economic activities, and to ensure that the equipment is used for the welfare of the community.



**3.2.6 UNDP and the World Bank emphasize the role of women in development. In most Trarza villages, the permanent population consists mainly of women, as the men only stay for a short while and go elsewhere to seek gainful employment. Such is the case in particular of the formerly nomadic Moors.**

Women will benefit greatly from this project, particularly from drinking water, vegetable gardening, and health stations. In these areas, and as regards hygiene issues in particular, women will be the main target of the instructional and informational field activities.

The project team will ensure that women are not excluded from the decision-making or management processes regarding the purchase and use of equipment. Although there is no action focusing strictly on women, as the equipment under consideration is meant for all, the project team will endeavour to involve women in all project activities. Specifically, women will be involved in the identification of the needs (where women's needs will have to be specified, see Activity 1.1.1), in the method to select the villages, and in the involvement of women in management activities.

**3.2.7 Training for basic maintenance and use of the equipment. Training will be provided to the end-users, aimed at two types of audiences:**

- The individuals in charge of the equipment, included in their training will be management, equipment valuation and finance.
- The technicians whose training will consist of basic maintenance. End-users will not be taught extensive skills regarding maintenance, which is better left to professionals. Routine maintenance and malfunction detection, however, will be entrusted to the village technician.

The training will be conducted in groups whenever possible, through workshops or seminars convened locally.

**3.2.8 Impact evaluation and installation performance assessment. The equipped villages will be monitored in order to acquire detailed knowledge of the social and economic use patterns, and to detect possible problems. This will be performed by the project team with the help of sociology experts.**

The following evaluation activities will be conducted:

- Visits to the villages by the project team in order to examine the usage patterns and to identify possible difficulties, to interface with the users, and give advice where needed. A monthly visit will be required during the initial phase. The observations will be recorded on a follow-up sheet with indications on several predefined indicators.
- Availability, within the project area, to respond promptly to any request from the villages, or simply for informal exchanges with the beneficiaries.

- Analysis of the follow-up sheets and establishment of a database including the data recorded. A comparison between the various installations, for example, could reveal specific features warranting further investigation.
- Occasional analysis missions by GRET or by the sociology experts. These missions will provide an external point of view, frequently a broader one, and allow comparisons with other countries.

### Activities, responsibilities and support for Output 3.2

|       | <i>Activities</i>   | <i>Responsibility</i> | <i>Support</i>                                      |
|-------|---|-----------------------|---|
| 3.2.1 | Socioeconomic analysis of the general context                     | GRET project team     | Sociologists<br>Morocco project expert (MPE)        |
| 3.2.2 | Definition of site selection method                               | GRET project team     | Sociologists and MPE<br>GRET support team           |
| 3.2.3 | Definition of practical management method                         | GRET project team     | Sociologist and MPE<br>SIDI                         |
| 3.2.4 | Support to various sub-groups to help formulate their needs       | GRET project team     | Sociologists  |
| 3.2.5 | Setting up management structures as defined                       | GRET project team     |   |
| 3.2.6 | Promoting women's participation                                   | GRET project team     | Sociologists  |
| 3.2.7 | Training for basic maintenance and technical use of the equipment | GRET project team     | GRET support team<br>NKC University<br>Sociologists |
| 3.2.8 | Impact evaluation and performance assessment                      | GRET project team     | Sociologists<br>GRET support team                   |

### IMMEDIATE OBJECTIVE 4

Promote and disseminate at the national, subregional and regional levels, wind electric systems and their diffusion mechanism, based on the experience gained from the project.

## **Output 4.1**

Broad dissemination of project information to the concerned audiences, and funding agencies in particular, with clear and effective reports and presentations. This output is to be obtained by the end of Phases 1 and 2.

The Mauritanian administration, the financial institutions, the private sector, and the public at large (both in and outside of Mauritania) will be broadly informed on the potential uses of wind turbines, their various applications, their costs, and the conditions of purchase (addresses of distributors and financial terms).

Clear documentation presenting all aspects of the project including its approach, the mechanisms created, the actual results, and their consequences will be produced. The documentation will be in French, Arabic and English, both as print documents and video presentations. Some of the latter will also be produced in the local languages.

### **Activities for Output 4.1 (Phases 1 and 2)**

- 4.1.1 Some publications will be produced in order to focus on specific technical or socioeconomic aspects. They will provide synthetic information allowing a sharing of the experience with similar projects. This synthesis work is necessary in order to provide information which is easily used by external interested parties.

Publications for Phase 1 include:

- Market study
- Presentation of existing equipment
- Presentation of technical approaches
- Characteristics of the installations
- Evaluation of Phase 1 installations (technical notes).

Publications for Phase 2 include:

- Characteristics of installed systems
- Economic notes on each technical approach
- Presentation of the diffusion mechanism.

- 4.1.2 Video presentations will be used to show the situation in the villages before, during, and after installation of the electrical equipment. A local company or the national Mauritanian television company will assume responsibility for this task.

The video presentations are meant to inform the public. In particular, they will be targeted at the villages by showing them the characteristics, advantages, disadvantages, management, organization, and costs of the systems; and at "technical" audiences, such as the institutions, private sector and banks.

The project will seek separate assistance for the production of a professional motion picture film. In addition to the detailed video productions mentioned above, this film will provide a means of monitoring the progress of the project, its operations, the problems encountered, and above all, its results and the impacts of rural electrification. Producing such a film requires substantial means and periodic visits. There is no provision for it in the project budget.

A series of photographs and slides will be collected in order to make presentations. The photographs may be taken by a local consultant, for example, the video production company.

- 4.1.3 A seminar will be organized upon completion of Phase 1 in order to present the results obtained. The target audience will be the Mauritanian public, but it will also be open to West African participants in general. The seminar theme will be rural electrification. While it will not be entirely devoted to wind turbines, this seminar will help enhance the position of Mauritania as the wind energy technology centre, with the support of the Department of Energy/University group. Also included will be on-site field visits.

Likewise, a more important international seminar will be organized as Phase 2 reaches completion. This seminar will aim at establishing linkages between various projects concerned with rural electrification.

#### **Activities, responsibilities and support for Output 4.1**

|       | <i>Activities</i>       | <i>Responsibility</i> | <i>Support</i>                            |
|-------|-------------------------|-----------------------|---|
| 4.1.1 | Technical presentations | GRET project team     | GRET support team<br>Department of Energy |
| 4.1.2 | Video documentation     | Special consultant    | GRET project team                         |
| 4.1.3 | Seminars                | GRET project team     | Department of Energy<br>GRET support team |

#### **Output 4.2**

A reliable database on the wind energy resource in Mauritania to be obtained by the end of Phases 1 and 2.

##### Activities for Output 4.2 (Phase 1)

- 4.2.1 The data available are those on which the current wind map of Mauritania is based. The reliability of these data and the condition of the measuring instruments from which they were produced will be reviewed. A list of the raw data and extrapolated data will be drawn up, and the reliable raw information will be isolated.

It will also be useful to check on the Senegalese side for the existence of wind data along the river. A Canadian organization is preparing a wind map for Senegal, in addition to the usual systems of the Senegalese weather forecasting office. The wind conditions over the river are similar on both sides of the border.

This review will also draw upon known regional data (for example, data from the Pacific Northwest Laboratories in the United States).

Based on this information, a new wind map of Mauritania will be produced. This map will be more precise than the current map, and will include mean wind speeds, distribution of wind velocity (Weibull parameters), and seasonal variations in wind speed.

- 4.2.2 Sixteen anemometers will be installed in the six main geographical zones (see Activity 1.1.1). In each zone, two sites will be selected. Each zone will be equipped with a simple recording anemometer and a station for measuring wind velocity distribution. Four additional recording anemometers will be installed in the project pilot zones. Daily readings will be taken manually from the recording anemometer by a person who will mail the readings regularly to CNEA.

The measuring station memorizes one measurement every ten minutes (average on the past 10 minutes), in other words, 144 measurements per day. The ideal solution is to set the memory size to a value requiring only two readings to be made per trimester. The measuring station will allow the distribution parameters to be defined, and permit validation of all other measures registered by the recording anemometer. The sites for the measuring stations will be selected during the needs assessment study, at the start of Phase 1.

#### Activities for Output 4.2 (Phases 1 and 2)

- 4.2.3 DE/CNEA will be in charge of data collection and analysis. Specific support will be provided by the support team experts in order to set up the data analysis protocols strictly in conformity with established international norms.

The recording of data will have to be performed over several years, in other words, for the entire duration of the project. Data recording for this period is necessary in order to ascertain the durability of the wind conditions over time, and to balance the production of energy by the wind turbines with the exact quantity of wind received.

- 4.2.4 The results from the measurements will be published yearly, as tables and graphs, and a map of the wind for Mauritania will be drawn up.

## Activities, responsibilities and support for Output 4.2

|       | <i>Activities</i>                           | <i>Responsibility</i> | <i>Support</i>                       |
|-------|---|-----------------------|--------------------------------------|
| 4.2.1 | Review of available data                    | DE/CNEA               | Experimentation expert<br>University |
| 4.2.2 | Choice of measurement sites                 | DE/CNEA               | GRET project team                    |
| 4.2.3 | Sub-project for the collection of wind data | DE/CNEA               | Experimentation expert<br>University |
| 4.2.4 | Wind energy atlas of Mauritania             | DE/CNEA               | Experimentation expert<br>University |

### Output 4.3

The wind energy technologies developed within the framework of this project will be used by other programmes which will use them as development tools in rural areas. For this purpose, the project team and the Department of Energy will have to conduct information and promotion activities based on the information acquired within the project. These activities will have to be based on the results obtained so that only quality information will be provided. This output is to be obtained by the end of Phases 1 and 2.

#### Activities for Output 4.3 (Phases 1 and 2)

- 4.3.1 Advertising and promotion activities based on the results obtained (see Output 4.1). On-site visits of the installations will be organized for donors and interested parties (NGOs, bilateral or multilateral agencies, state entities, and others).

Broad distribution of the documents concerning the project to other developing countries. For this purpose, short, summary documents in French and English must be available (see Output 3.2). The distribution of these documents will have to be methodically and voluntarily organized. This information will be primarily targeted at donors both in French- and English-speaking countries.

The project will design a mailing activity to promote its results and approaches to rural electrification. This activity will be predicated upon significant promising results with sufficient field data to establish a firm scientific grounding.

#### Activities for Output 4.3 (Phase 2)

- 4.3.2 Through international meetings, by publication in the specialized press, and by organizing seminars in Mauritania, a network of contacts and relations will be established at the

international level. The summary documents concerning the project will be systematically communicated to the network members.

The policy announced within this project of using summary notes will also be suggested to the other network members. The purpose is to set up an informal network of interested parties exchanging notes on innovative themes drawn from their own work, and meeting from time to time during international events. Any person interested in duplicating the project will also be encouraged to visit project installations.

- 4.3.3 Joint sponsorship of a seminar for donors which could have an important impact if it is organized in conjunction with recognized participants such as CFD, the World Bank, GTZ, and IEPF. Project Alizés-électrique could initiate such a seminar and serve as a co-sponsor. The important point is to submit sound proposals based on experience to the donors and national decision-makers, in order to develop rural electrification activities in developing countries.

#### **Activities, responsibilities and support for Output 4.3**

|       | <i>Activities</i>                                 | <i>Responsibility</i>        | <i>Support</i>                                   |
|-------|---|------------------------------|--|
| 4.3.1 | Promotion and publication of information acquired | GRET support team<br>DE/CNEA | GRET support team<br>DE                          |
| 4.3.2 | Implementation of international relations network | GRET project team<br>DE/CNEA | GRET support team<br>DE                          |
| 4.3.3 | Joint sponsoring of a seminar for donors          | GRET project team            | GRET support team<br>DE/CNEA<br>Other organizers |

### **IMMEDIATE OBJECTIVE 5**

Help establish the financial arrangements for Phase 2 of the project.

#### **Output 5.1**

Financial arrangements will be in place for Phase 2. This output is to be obtained by the end of Phase 1.

#### **Activities for Output 5.1 (Phase 1)**

- 5.1.1 The objectives and activities of Phase 2 are already included in this project. A series of new elements, however, will result in modifying the project for Phase 2. Among these new

elements are the results of the first market studies, types of solutions selected for financing, direction of orientations as concerns the needs to be satisfied, and choice of usable forms of energy. This situation will require redefining the objectives and activities with a view to reflecting actual conditions more accurately. A detailed budget will also need to be determined. To this end a new project document will be drafted for Phase 2. This task will be performed at the end of the first year, or at the beginning of the second year, in consultation with previously identified donors.

- 5.1.2 At the time of project initiation, the financing arrangements for Phase 2 will not yet be in place. One donor, Coopération Française, has already indicated interest. No firm commitment has been made, however, whether on the principle, or on the amount of the financial assistance. It is therefore necessary to continue the negotiations with Coopération Française and study the terms of their participation in the project, and contact other potential donors in order to diversify the sources of financing.

The search for donors for Phase 2 will be conducted in cooperation with the Steering Committee. The project team will have to make the committee aware of that need and provide it with the necessary documentation. Likewise, UNDP Headquarters and the GEF office will have to contribute to this effort.

- 5.1.3 The donors will be associated with the execution of the project. They will be involved through participation as observers within the Steering Committee (for example, for the Caisse Française de coopération), distribution of reports, and requests for opinions on issues closely linked to financing, such as the creation of the rural pre-electrification company. They will also be invited to participate in the seminar at the end of Phase 1 (Activity 1.5.5).

- 5.1.4 Based on the different types of relations established with the donors and the follow-up, a round table for donors will be organized in order to make the necessary financing arrangements for Phase 2. This exercise should take place immediately at the beginning of year 2 to ensure continuity of the financing flows between Phases 1 and 2.

#### Activities, responsibilities and support for Output 5.1

|       | <i>Activities</i>   | <i>Responsibility</i>                  | <i>Support</i>           |
|-------|---|--|--------------------------|
| 5.1.1 | Drafting of a revised project document for Phase 2                    | GRET support team                      | GRET project team<br>DE  |
| 5.1.2 | Search for donors   | GRET support team<br>GEF               |                          |
| 5.1.3 | Information for and consultation with potential donors during Phase 1 | GRET support team<br>GRET project team | DE                       |
| 5.1.4 | Organization of a round table for donors                              | GRET support team<br>GRET project team | DE<br>Steering Committee |



## **E. INPUTS**

### **1. Government of the Islamic Republic of Mauritania**

#### **Personnel**

The government is seconding two engineers to the project, one assigned to the GRET team, and the other to the Department of Energy. A half-time secretary is also assigned to the Department of Energy. The government is also providing a project coordinator, the Director of Energy, on a part-time basis, to ensure the general supervision of the project and to head the Steering Committee.

#### **Facilities**

Suitably equipped premises to serve as office for the Department of Energy team in charge of the project, as well as a computer and printer will be provided.

### **2. Beneficiaries**

There are no inputs from beneficiaries at the present stage of the project. Within the diffusion phase, however, provision has been made to request a financial contribution from the beneficiaries for the purchase of equipment. If this request is granted, it will constitute a financial input towards the realization of the project's objectives.

### **3. Global Environment Facility**

The GEF will provide staff for the project under the categories listed below.

#### **Personnel**

##### ***GRET Project Implementation Team***

- One project manager
- Two social workers
- One logistics agent
- One messenger
- One driver
- A technical director, seconded by the Department of Energy
- GRET will provide supervisory support to this team.

##### ***Department of Energy Implementation Team***

- One accountant
- One driver
- Three wind data collectors.

### *Technical experts*

- Three wind energy experts, of whom only one will visit Mauritania on a mission (1.6 m/m). Tasks will include: identifying existing equipment, selecting technical application, and providing support for the preparation of the international competitive bid.
- One technical trainer (4 m/m) whose tasks will include providing training to Mauritanian private enterprises.
- Two experimentation experts who may be chosen among the four experts mentioned above (5.7 m/m). Tasks for these experts will include: defining test protocols, performing experiments, and training Department of Energy personnel.
- One external technical expert for the review of the bids (0.4 m/m).
- The wind turbine supplier will also provide training services to the selected local enterprises (1.2 m/m).

### *Development methodology experts*

The GEF will provide the following development methodology experts:

- Two sociology experts—one international expert and one Mauritanian expert—(2.4 m/m). Their tasks will include: participating in the needs assessment, providing training to the project team, and ensuring sociological monitoring.
- One expert from a similar project in Morocco (0.7 m/m) whose tasks will include providing support for the needs assessment and formulation of surveys.
- One GRET expert for socioeconomic monitoring in Mauritania (2 m/m) whose tasks will include monitoring project team activities, and the socioeconomic aspects of project activities.

### *Financial experts*

SIDI/IDM or another entity capable of providing similar services will provide expertise to the enterprises in the area of financial support, economic activities, and financial arrangements. This activity amounts to some 40 m/m essentially provided by national personnel.

### *Miscellaneous subcontracts*

Specialized companies will be called upon for the production of videotapes and photographs.

### *Preparation and supervision*

Identification mission (four experts for a total of 4 m/m), creation of a STEC to conduct regular monitoring of the project's activities, and provide evaluation thereof.

### *UNDP Country Office support*

In support of national execution, the UNDP Country Office in Mauritania will perform the monitoring and management, organize the annual audit, technical supervision, procurement of some pieces of equipment, recruit experts as needed, and prepare and coordinate the expert missions. This activity will require approximately one full-time position.

### Travel in connection with training

Training sessions abroad will require two visits for the Department of Energy personnel, and two for the project team (including the Department of Energy engineer seconded to the project). Participation in seminars will require four seminars for Department of Energy personnel (1.7 m/m).

Provisions for fellowships will include one month abroad for Department of Energy personnel, and two training sessions at the facilities of the supplier for the selected local enterprise staff (total 2 m/m). Provision is also made for local training sessions on specific aspects (2 m/m).

### Support equipment

| <i>Equipment and materials</i> | <i>Users</i>                |                     |
|--------------------------------|-----------------------------|---------------------|
|                                | <i>Department of Energy</i> | <i>Project team</i> |
| Computer                       | 2                           | 3                   |
| Printer                        | 1                           | 2                   |
| Photocopier                    | 1                           | 1                   |
| Fax machine                    | 1                           | 1                   |
| Photo equipment                |                             | 2                   |
| Telephone/modem                |                             | 1                   |
| Office furniture               | X                           | X                   |
| Off-road vehicles              | 1                           | 2                   |
| Local travel vehicles          | 1                           | 1                   |
| Motorcycle                     |                             | 1                   |
| Tech. equipment & tools        | X                           | X                   |

### Field equipment

Measuring instruments will be needed to equip the two experimentation sites. At least six anemometers are to be installed in the areas selected for the wind resource study.

Wind power equipment must be tested, including the downstream electric power application systems. The experimentation fund is managed by the Department of Energy and GRET. The equipment tested in France will then be shipped to Mauritania to be used at the experimentation sites in Nouakchott.

Equipment to be installed in the villages includes fifteen wind electric power systems of approximately 1 to 2 kWe, and approximately forty small wind electric power systems of 50 to 250 We.

### Backstopping

Office space will be provided for the project team, including a three-room office in the pilot installation area (Rosso), and one management office in Nouakchott (three to four rooms).

Provisions for logistics will be made, including expenses covering operating costs in connection with office, telecommunications, reports and vehicles for the project team, Department of Energy and the UNDP field office. Documentation support will also be provided.

## **F. RISKS**

Several types of risks are involved in this project.

### **1. Risks in connection with acceptance by beneficiaries**

As part of the project consists precisely in assessing the needs and studying the market, such assessments and studies may reveal that some applications which we consider interesting and economically profitable for Mauritania are, in fact, not useful, and it would be ill-advised to develop them. This possibility will only become known with any degree of certainty after the studies have been completed, and there is therefore a risk that some applications will not be developed (for example, milk or fish storage).

This potential is however a limited risk for two reasons. The needs to be assessed have been selected based on a pre-assessment and general knowledge of the market from GRET and the manager of Project Alizés, as well as on information provided by the Mauritanian personnel in charge during the preparatory missions. Despite possible error, a set of converging information indicates that the needs do exist. In addition, based on the activities undertaken in other developing countries, a total lack of development opportunities appears unlikely. In particular, household demand for electric power is always high and the costs are always partly recoverable. In a worst case scenario, therefore, the assessment phase will narrow the range of technical applications, and will require a refocusing of the financial participation on the part of the buyers according to their ability to pay, as determined during the assessment phase.

## **2. Risk in connection with local operators**

The project aims at establishing a true industrial policy based on the development of renewable energies. This objective requires strong partners with superior corporate leadership and management capabilities—a mix of qualities not frequently encountered in Mauritania. There is therefore a risk that the ideal partner may not be found, or that the results expected from the selected enterprises may not be forthcoming. The existing risk here is strictly related to the corporate management and leadership capabilities, not to the technical capacities, which do exist and are easy to build through appropriate technical training programmes.

A partnership with IDM and SIDI appeared best-suited to protect against this risk. Acquiring interest in the company will allow for a degree of control and very close monitoring of the activities of the company. The monitoring provided by IDM in the areas of enterprise management and planning will provide greater assurances in establishing the desired capabilities.

## **3. Risk in connection with the lack of Phase 2 financing**

The project objective will actually be reached only if Phase 2 can be executed, as the diffusion mechanism will not be put into place, let alone validated, during Phase 1. The inability to execute Phase 2 would therefore result in certain failure for the project. There is still no indication to date as to how easy or difficult it will be to mobilize funds to support Phase 2. This is therefore a real risk, which must be known and addressed to ensure that GEF or other donors organizations provide the support required to bring the project to full completion.

## **G. PRIOR OBLIGATIONS AND PREREQUISITES**

None.

## **H. PROJECT REVIEW, REPORTING AND EVALUATION**

### **1. Tripartite Review**

The project will be subject to review by representatives of the government, UNDP Country Office, and GEF at least once every year. The first meeting will take place within twelve months following project start-up. The National Coordinator will draft a report evaluating the results of the project in cooperation with the project manager and GRET, to be submitted to the Tripartite Review meeting. Other reports may be required from time to time during the course of the project.

A draft final report will be prepared for the final Tripartite Review. A preliminary version of the report will be prepared in advance so that the UNDP field office may examine it and give final approval at least four months prior to the final Tripartite Review.

### **2. Reports**

Progress performance reports will be prepared every six months by the National Coordinator and the project, according to the guidelines and procedures established by UNDP for project

supervision and execution. The reports will deal with the socioeconomic, technical, administrative, and financial inputs.

All reports produced by the project will be submitted, together with a summary note, according to a predefined model. This format will allow presentation of the key elements to which the reporting entity is drawing the attention of the reader. These summary notes will include key words and be entered in a database (of the DPH or Technap network type).

A list of all reports produced by the project is given in Annex 2. The reports will be produced in French, except for the final performance evaluation report which will also be produced in English. Some notes summarizing reports will also be translated into English. Following is a list of the main reports which will be useful to the monitoring and supervisory entities.

### Project reports and schedule

| <i>Type of report</i>   | <i>Schedule<br/>(months after start-up)</i> |
|---|---|
| <ul style="list-style-type: none"> <li>Needs assessment and pilot zone proposals</li> <li>Activity report</li> </ul>                              | 4   |
| <ul style="list-style-type: none"> <li>Report on the assessment, zone selection and equipment selection phase</li> <li>Activity report</li> </ul> | 9   |
| <ul style="list-style-type: none"> <li>Activity report (for the Steering Committee)</li> </ul>  | 12  |
| <ul style="list-style-type: none"> <li>Activity report (for final Tripartite Review)</li> </ul>   | 18  |
| <ul style="list-style-type: none"> <li>Phase 1 report - draft</li> <li>Phase 1 report - final</li> </ul>  | 21<br>25                                    |

### 3. Evaluation

The project evaluation will be conducted by the STEC once a year, upon a two-week mission which will also draw on local resources. The organizational structure, features, and schedule of this exercise will be determined by UNDP Headquarters after consultations between the parties (Government, UNDP field office and executing NGO).

## **I. LEGAL CONTEXT**

This Project Document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of Mauritania and UNDP. For purposes of this agreement, the host country implementing agency will be the government cooperating agency mentioned in the agreement.

The following amendments may be made to the original Project Document, even if they are signed only by the UNDP Resident Representative, provided the latter is assured that all other signatories of the Project Document have no objections to the amendments:

- Revisions in, or additions to, any of the annexes of the document
- Revisions which do not result in major changes in the project's immediate objectives or outputs, and which are attributable to a reordering of the activities or inputs in order to improve the realization of the objectives and outputs, such as modifications agreed to by the Steering Committee, cost increases due to inflation, and so on
- Necessary yearly revisions made to reorganize the provision of already scheduled inputs, to reflect an increase in the cost of expert services or other services due to inflation, or to take into account the preferential treatment granted for reimbursement of the implementing agencies' expenses.

## **J. BUDGET**

The total budget support solicited from UNDP/GEF is US\$ 2 million, including an OPS-executed project preparatory phase with an associated budget of US\$ 150,000. The detailed project budget is attached.

## PROJECT BUDGET

Project Title: Decentralized Wind Electric Power for Social and Economic Development  
(Alizés-électrique)  
Project Number: MAU/93/G31

|   | Implement-<br>ation | Year 1 |         | Year 2 |         | Total |           |
|---|---------------------|--------|---------|--------|---------|-------|-----------|
|   |                     | mm     | USD     | mm     | USD     | mm    | USD       |
| <b>10.00 PERSONNEL</b>                        |                     |        |         |        |         |       |           |
| 13.00 Administrative support personnel        |                     |        |         |        |         |       |           |
| 13.01 Accountant                              | Gvmt                | 12     | 5,000   | 12     | 5,150   | 24    | 10,150    |
| 13.02 Driver                                  | Gvmt                | 12     | 4,100   | 12     | 4,223   | 24    | 8,323     |
| 13.03 Wind data collection (technician)       | Gvmt                |        | 815     |        | 860     |       | 1,675     |
| 13.99 Subtotal                                |                     | 12     | 9,915   | 12     | 10,233  | 24    | 20,148    |
| 15.00 Field missions                          |                     |        |         |        |         |       |           |
| 15.01 Lump sum travel expenses                | Gvmt                |        | 7,500   |        | 7,500   |       | 15,000    |
| 15.99 Subtotal                                |                     |        | 7,500   |        | 7,500   |       | 15,000    |
| 16.00 Costs of preparatory missions           |                     |        |         |        |         |       |           |
| 16.01 Preparatory assistance                  | OPS                 |        | 104,000 |        |         |       | 104,000   |
| 16.99 Subtotal                                |                     |        | 104,000 |        | 0       |       | 104,000   |
| 19.00 Total Personnel                         |                     |        | 121,415 |        | 17,733  |       | 139,148   |
| <b>20.00 SUB-CONTRACT</b>                     |                     |        |         |        |         |       |           |
| 20.01 Contract with NGO                       | PNUD/L              |        | 665,545 |        | 825,202 |       | 1,490,747 |
| 20.02 Audit                                   | PNUD/L              |        | 5,000   |        | 5,000   |       | 10,000    |
| 20.99 Total - Subcontract                     |                     |        | 670,545 |        | 830,202 |       | 1,500,747 |
| <b>30.00 TRAINING</b>                         |                     |        |         |        |         |       |           |
| 32.00 Study trips/group training              |                     |        |         |        |         |       |           |
| 32.01 Participation in seminars               | Gvmt                |        | 8,200   |        | 5,700   |       | 13,900    |
| 32.02 Study trips                             | Gvmt                |        | 4,600   |        |         |       | 4,600     |
| 32.03 Short-term fellowships                  | Gvmt                |        | 6,100   |        |         |       | 6,100     |
| 32.04 Experiments in France, technical visits | Gvmt                |        | 8,400   |        | 8,400   |       | 16,800    |
| 33.00 On-the-job training                     | Gvmt                |        | 1,000   |        | 4,000   |       | 5,000     |
| 39.00 Total - TRAINING                        |                     |        | 28,300  |        | 18,100  |       | 46,400    |
| <b>40.00 Materials and Equipment</b>          |                     |        |         |        |         |       |           |
| 41.00 Consumables                             | Gvmt                |        | 1,500   |        | 1,500   |       | 3,000     |
| 42.00 Non-consumable materials & equipment    |                     |        |         |        |         |       |           |
| 42.01 Computer/printer                        | Gvmt                |        | 6,200   |        |         |       | 6,200     |
| 42.02 Photocopier                             | Gvmt                |        | 2,000   |        |         |       | 2,000     |
| 42.03 Fax                                     | Gvmt                |        | 800     |        |         |       | 800       |
| 42.04 Office furniture                        | Gvmt                |        | 2,000   |        |         |       | 2,000     |
| 42.05 4-wheel drive field vehicle             | Gvmt                |        | 17,000  |        |         |       | 17,000    |
| 42.06 Vehicle for local travel                | Gvmt                |        | 8,000   |        |         |       | 8,000     |
| 42.07 Technical materials                     | Gvmt                |        | 2,000   |        | 1,000   |       | 3,000     |
| 42.19 Subtotal                                |                     |        | 38,000  |        | 1,000   |       | 39,000    |
| 42.20 Materials for test and experiments      |                     |        |         |        |         |       |           |
| 42.20.1 Anemometers                           | Gvmt                |        | 13,500  |        |         |       | 13,500    |
| 42.20.2 Measurement equipment                 | Gvmt                |        | 8,000   |        |         |       | 8,000     |
| 42.20.3 Wind turbines and test equipment      | Gvmt                |        | 45,000  |        |         |       | 45,000    |
| 42.20.9 Subtotal                              |                     |        | 66,500  |        | 0       |       | 66,500    |
| 42.99 Total - non-consumables                 |                     |        | 104,500 |        | 1,000   |       | 105,500   |
| 49.00 Total - Materials and Equipment         |                     |        | 106,000 |        | 2,500   |       | 108,500   |



PRODOC Alizés-électrique

|   | Implemen-<br>tation | Year 1 |                    | Year 2 |                  | Total |                    |
|---|---------------------|--------|--------------------|--------|------------------|-------|--------------------|
|   |                     | mm     | USD                | mm     | USD              | mm    | USD                |
| <b>50.00 MISCELLANEOUS</b>                      |                     |        |                    |        |                  |       |                    |
| 51.00 Operation and maintenance                 |                     |        | 12,500             |        | 12,500           |       | 25,000             |
| 51.01 Vehicle maintenance                       | Gvmt                |        | 10,000             |        | 10,000           |       | 20,000             |
| 51.02 Operating costs                           | Gvmt                |        | 2,500              |        | 2,500            |       | 5,000              |
| 52.00 Report preparation                        | Gvmt                |        | 500                |        | 500              |       | 1,000              |
| 53.00 Miscellaneous support                     |                     |        | 500                |        | 500              |       | 1,000              |
| 53.01 Miscellaneous                             | Gvmt                |        | 500                |        | 500              |       | 1,000              |
| 54.00 Support of UNDP Country Office            |                     |        | 34,103             |        | 34,103           |       | 68,205             |
| 54.01 Baseline support (3%)                     | UNDP/CO             |        | 30,000             |        | 30,000           |       | 60,000             |
| 54.02 Supplementary tasks                       | UNDP/CO             |        | 4,103              |        | 4,103            |       | 8,205              |
| 55.00 Support of UNDP Headquarters              |                     |        | 55,000             |        | 55,000           |       | 110,000            |
| 55.01 Backstopping support (3%)                 | UNDP/HQ             |        | 30,000             |        | 30,000           |       | 60,000             |
| 55.02 Scientific & technical advisory committee | UNDP/HQ             |        | 25,000             |        | 25,000           |       | 50,000             |
| <b>59.00 Total - MISCELLANEOUS</b>              |                     |        | <b>102,603</b>     |        | <b>102,603</b>   |       | <b>205,205</b>     |
| <b>TOTAL BUDGET (US\$)</b>                      |                     |        | <b>\$1,028,863</b> |        | <b>\$971,138</b> |       | <b>\$2,000,000</b> |

Gvmt : Government of Mauritania  
 UNDP/CO : UNDP Country Office (Nouakchott)  
 UNDP/HQ : UNDP Headquarters (RBA/GEF)

# COUNTERPART BUDGET

|                      |                              | Year 1 |                  | Year 2 |                  | Total |                  |
|----------------------|------------------------------|--------|------------------|--------|------------------|-------|------------------|
|                      |                              | h/m    | USD              | h/m    | USD              | h/m   | USD              |
| <b>10.00</b>         | <b>Personnel</b>             |        |                  |        |                  |       |                  |
|                      | 1 engineer with project      | 12     | 9,100            |        | 9,555            |       | 18,655           |
|                      | 1 CNEA engineer              | 12     | 9,100            |        | 9,555            |       | 18,655           |
|                      | National coordinator         | 3      | 4,530            |        | 4,757            |       | 9,287            |
|                      | 1 secretary                  | 12     | 1,900            |        | 1,995            |       | 3,895            |
|                      | 1 driver                     | 12     | 1,700            |        | 1,785            |       | 3,485            |
|                      | <b>19.00 Total personnel</b> |        | <b>26,330</b>    |        | <b>27,647</b>    |       | <b>53,977</b>    |
| <b>40.00</b>         | <b>Equipment</b>             |        |                  |        |                  |       |                  |
|                      | <b>42.00 Non-consumables</b> |        |                  |        |                  |       |                  |
|                      | 42.01 Computer/printer       |        | 2,800            |        |                  |       | 2,800            |
|                      | <b>49.00 Total equipment</b> |        | <b>2,800</b>     |        |                  |       | <b>2,800</b>     |
| <b>50.00</b>         | <b>Miscellaneous</b>         |        |                  |        |                  |       |                  |
|                      | Vehicle operation            |        | 3,800            |        | 3,990            |       | 7,790            |
|                      | Telecommunications           |        | 4,500            |        | 4,725            |       | 9,225            |
|                      | Office furnishings           |        | 1,800            |        | 1,890            |       | 3,690            |
|                      | Local rentals                |        | 945              |        | 992              |       | 1,937            |
|                      | <b>Total miscellaneous</b>   |        | <b>11,045</b>    |        | <b>11,597</b>    |       | <b>22,642</b>    |
| <b>TOTAL (US \$)</b> |                              |        | <b>\$40,175</b>  |        | <b>\$39,244</b>  |       | <b>\$79,419</b>  |
| <b>TOTAL (UM)</b>    |                              |        | <b>4,724,580</b> |        | <b>4,170,041</b> |       | <b>8,894,621</b> |

## Consultants (Mauritanian and international)

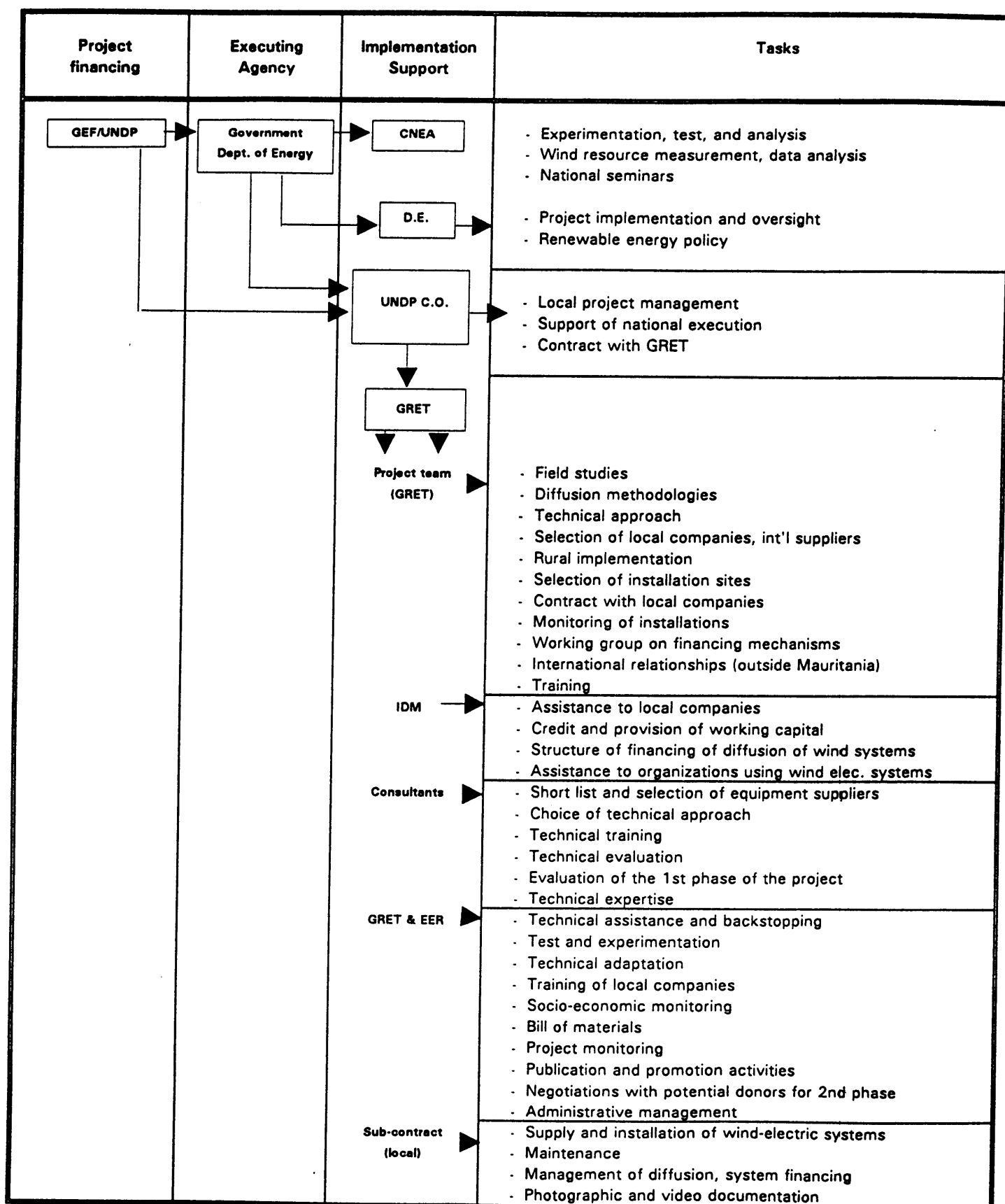
### Year 1

| Consultants             | Principal Tasks  | Air fare  | Per diem   | Days       |
|-------------------------|--|-----------|------------|------------|
| Wind electric expert #1 | Review of available technology, choice of potential suppliers, preparation of the ICB  | 0         | 14         | 5          |
|                         |  | 1         |            | 15         |
| Wind electric expert #2 | Review of technology   | 0         |            | 5          |
| Wind electric expert #3 | Review of technology   | 0         |            | 8          |
| Tech. transfer expert   | Review of the ICB results  | 1         | 7          | 8          |
| Technical trainer       | Fabrication, assembly, installation, and maintenance   | 1         | 28         | 27         |
| Experimental expert #1  | Establishment of the program and protocol for test and experimentation, experimental work, choice and ordering of the systems, | 1         | 11         | 10         |
|                         |  | 0         |            | 29         |
| Experimental expert #2  | (same as above)  | 0         |            | 28         |
| Sociologist #1          | Study of needs, training of the project team   | 1         | 14         | 15         |
| Sociologist #2          | (same as above)  |           | 14         | 15         |
| Supplier                | Choice of local private sector participant, training   | 1         | 11         | 0          |
|                         |  | 1         | 14         | 0          |
| Moroccan experts        | Development of field survey methodology and instrument   | 1         | 14         | 0          |
| GRET supervision        | Supervision, backstopping, socio-economic analysis   | 2         | 24         | 55         |
| <b>TOTAL Year 1</b>     |  | <b>10</b> | <b>151</b> | <b>220</b> |

### Year 2

| Experts                | Principal Tasks   | Air fare | Per diem   | Days       |
|------------------------|---|----------|------------|------------|
| Technical trainer      | Assembly and fabrication, installation and maintenance                        | 2        | 56         | 55         |
| Sociologist #1         | Follow-up   | 1        | 10         | 10         |
| Sociologist #2         | Follow-up   |          | 10         | 10         |
| Experimental expert #1 | Experimentation, choice and ordering of systems                               | 0        |            | 27         |
|                        |   |          |            |            |
| Experimental expert #2 | (same as above)   | 0        |            | 26         |
| GRET supervision       | Supervision missions and support to the socio-economic aspects of the project | 2        | 24         | 55         |
| <b>TOTAL Year 2</b>    |   | <b>5</b> | <b>100</b> | <b>183</b> |

**Annex 1**  
**PROJECT AND TASK ORGANIZATION**





### Local suppliers and manufacturers — selection, training and relations

| Responsibility  | Document                                       | Date |      | Remarks        |
|---|--|------|------|----------------|
|   |  | Year | Mnth |                |
| - Wind energy experts 1<br>- Wind energy experts 2<br>- Wind energy experts 3 | Suppliers' presentations                       | 1    | 02   |                |
| - Wind energy experts 1<br>- GRET project team                                | Call for bids document                         | 1    | 03   |                |
| - GRET project team   | Local small/medium scale companies survey      | 1    | 04   |                |
| - GRET project team<br>- Wind energy experts 1                                | Competition document                           | 1    | 04   |                |
| - Technology transfer expert  | Supplier's selection                           | 1    | 06   | Mission report |
| - GRET project team   | Local company selection                        | 1    | 07   |                |
| - Training expert<br>- Supplier   | Training report                                | 1    | 12   | Mission report |
| - Training expert   | Training report and technical evaluation       | 2    | 03   | Mission report |
| - IDM   | Support to small/medium scale companies report | 2    | 03   |                |
| - Training expert   | Training report and technical evaluation       | 2    | 08   | Mission report |
| - IDM   | Small/medium scale companies follow-up report  | 2    | 11   |                |

### Choice and diffusion of demonstration equipment

| <i>Responsibility</i>   | <i>Document</i>   | <i>Date</i> |       | <i>Remarks</i>                                 |
|---|---|-------------|-------|--|
|   |   | Year        | Month |  |
| - GRET project team   | Pilot zones proposal  | 1           | 04    |  |
| - Wind energy experts 1<br>- Wind energy experts 2<br>- Wind energy experts 3 | Presentation of existing equipment                              | 1           | 04    |  |
| - GRET project team   | Technical options specifications for Mauritania                 | 1           | 04    |  |
| - Wind energy experts 1   | Choice of technical options                                     | 1           | 06    | Mission report                                 |
| - GRET project team   | Conditions for attribution of wind electric equipment (Phase 1) | 1           | 06    |  |
| - GRET project team   | Sites selected for installations                                | 1           | 09    |  |
| - GRET project team   | Fact sheets describing the installations                        | 2           | 05    | Produced as the installations are being set up |

# Follow-up and evaluations

| <i>Responsibility</i> | <i>Document</i>  | <i>Date</i> |      | <i>Remarks</i> |
|-----------------------|--|-------------|------|----------------|
|                       |  | Year        | Mnth |                |
| GRET                  | Follow-up report   | 1           | 04   |                |
| GRET                  | Follow-up report   | 1           | 11   |                |
| GRET                  | Follow-up report and socioeconomic evaluation of installations | 2           | 04   |                |
| GRET                  | Follow-up report and socioeconomic evaluation of installations | 2           | 11   |                |
| Training expert       | Technical evaluation   | 2           | 03   |                |
| Training expert       | Technical evaluation   | 2           | 08   |                |
| Evaluation mission    | Phase 1 evaluation   | 2           | 12   |                |



**Experiments**

| <i>Responsibility</i>   | <i>Document</i>                         | <i>Date</i> |              | <i>Remarks</i>                                       |
|---|---|-------------|--------------|--|
|   |   | <i>Year</i> | <i>Month</i> |  |
| <ul style="list-style-type: none"><li>- Experiment expert</li><li>- DE</li><li>- University</li></ul> | Experimentation protocol                | 1<br>1      | 03<br>08     | Mission report<br>New protocol for end-use equipment |
| <ul style="list-style-type: none"><li>- Experiment expert</li><li>- DE</li><li>- University</li></ul> | Experimentation and support team report | 1           | 11           |  |
| <ul style="list-style-type: none"><li>- Experiment expert</li><li>- DE</li><li>- University</li></ul> | Experimentation and support team report | 2           | 11           |  |

**Formation**

| <i>Responsibility</i> | <i>Document</i>       | <i>Date</i> |              | <i>Remarks</i> |
|-----------------------|-----------------------|-------------|--------------|----------------|
|                       |                       | <i>Year</i> | <i>Month</i> |                |
| - GRET project team   | External visit report | 1           | 08           |                |

**Setting up the diffusion mechanism**

| <i>Responsibility</i>        | <i>Document</i>       | <i>Date</i> |              | <i>Remarks</i> |
|------------------------------|-----------------------|-------------|--------------|----------------|
|                              |                       | <i>Year</i> | <i>Month</i> |                |
| - IDM<br>- GRET project team | Progress report       | 1           | 12           |                |
| - IDM<br>- GRET project team | Preliminary proposals | 2           | 06           |                |
| - IDM<br>- GRET project team | Final proposals       | 2           | 11           |                |

**Wind data collection**

| <i>Responsibility</i> | <i>Document</i>         | <i>Date</i> |             | <i>Remarks</i> |
|-----------------------|-------------------------|-------------|-------------|----------------|
|                       |                         | <i>Year</i> | <i>Mnth</i> |                |
| Dept. of Energy       | Study of wind resources | 1           | 12          |                |
| Dept. of Energy       | Study of wind resources | 2           | 12          |                |

### Project performance reports

| <i>Responsibility</i>         | <i>Document</i>                       | <i>Date</i> |      | <i>Remarks</i>                          |
|-------------------------------|---------------------------------------|-------------|------|---|
|                               |                                       | Year        | Mnth |   |
| - Dept of Energy              | Quarterly progress report             | 1           | 07   |   |
| - GRET project team           | Analysis and selection phase report   | 1           | 09   | With activities for the next six months |
| - Dept of Energy              | Progress report for Year 1            | 1           | 12   |   |
| - GRET project team           | Report on installations               | 2           | 03   | With activities for the next six months |
| - Dept of Energy              | Quarterly progress report             | 2           | 07   |   |
| - GRET project team           | Phase 1 report                        | 2           | 11   | With activities for the next six months |
| - Gret<br>- GRET project team | Detailed project document for Phase 2 | 2           | 11   |   |
| - Dept of Energy              | Progress report for Phase 1           | 2           | 12   |   |

## **Annex 3**

### **TRAINING PROGRAMME**

#### **1. Trainees**

Training will be provided for four separate groups:

- Project personnel
- Staff of the private sector companies participating in the project
- Wind power equipment end-users
- Personnel of the Department of Energy for which this project has been designed with an actual capacity-building component.

#### **2. Training inputs**

##### **Expert missions**

A specialized technical trainer will be hired to develop and conduct the training programme. The training will be coordinated with the suppliers. It is also expected that during Phase 1, the main wind power equipment supplier will execute two missions in Mauritania, and the technical trainer will conduct three missions.

Technical training sessions will be aimed primarily at the staff of the Mauritanian companies concerned; however, participation by members of the GRET project team and the Department of Energy in these sessions will also contribute to expand the training of the project management team.

An expert from the rural electrification project of the Coopération Française in Morocco will be seconded on a training mission for the project team staff. Training will include survey techniques, needs assessment, and the types of technical/organizational solutions to be implemented.

The sociology experts in charge of identification services will also participate in training the project motivators in order to increase environmental awareness, and organize surveys and training and awareness raising programmes for the rural populations.

##### **Seminars and visits abroad**

Members of the Department of Energy and the project team will travel abroad in order to meet with equipment suppliers, visit installations, or attend seminars on wind energy. A total of six trips abroad is scheduled for the Department of Energy personnel, and three for the project team, essentially by the Department of Energy engineer assigned to the project under its training component. Two trips will be made by private sector personnel for visits of the counterpart supplier.

Training will be held in the suppliers' plants and in international testing and training centres such as Bushland, Texas (USA) and Petten, Netherlands, or Moules, France, upon the occasions of visits to other installations worldwide.

A stay of two months per year will be organized at the Moules base for two engineers from the Department of Energy: the engineer assigned to the project team, and the engineer in charge of testing. Such stays in France will contribute to a speedier technology transfer process, and make it possible to set up a fully operational base in Nouakchott.

The project will also seek external financing to provide additional training on the uses of small-scale wind electric power. The American Wind Energy Association organizes, for instance, a two-week seminar in the United States and a training programme each July, with visits to the main wind power equipment manufacturers, to field installations, and to government-supported installations where equipment testing is performed. The programme assumes the costs of all travel expenses for participants from developing countries. For 1993, an experienced engineer for the Department of Energy, who will be working on Project Alizés/é, has been invited to participate in the programme.

### Practical training

The best training is practical, with extensive hands-on experience. The Department of Energy engineer assigned to the project will be totally immersed in the execution of the project with complete freedom of action granted by the NGO supervision staff. He will be able to focus on the actions themselves more than on the administrative aspects, and to benefit from permanent exchanges within the GRET team. He will have complete autonomy and be assigned specific areas of responsibility. This practical non-formal training is the best type that may be imparted. Furthermore, the experience acquired in this manner will enhance the value of both external visits and participation in seminars.

### Specific training activities in Mauritania

Specific training services will have to be provided locally, for example, in language or computer science, in order to fill possible gaps in knowledge both for Department of Energy staff and for the personnel hired by the NGO.

The project activities also include training activities for the users of wind energy equipment. These will consist of training in technical areas, but also in electric systems management and organization. The project will use teaching material and training programmes (such as documents, manuals or videos) already developed to train technicians and engineers in the areas of installation, operation, and maintenance of wind electric systems from 50 W to 10 kW.

The training of local technicians will emphasize the safety aspects at the wind electric systems installation and maintenance stages. In particular, all personnel performing any repair work up on the tower will be required to wear a safety harness.

A study of training programmes and teaching materials currently available will be conducted before project start up. GRET will use the resources of the Association Européenne de l'énergie éolienne (EWEA), the American Association of Wind Energy, and other national and international suppliers associations to collect current data regarding the training programmes and materials. This will facilitate speedy hiring of staff and institutions to conduct the training activities during Phase 1 of the project.

Training of the project team will also be supported by means of collecting documentation on the themes of animation, technology transfer, environmental science, and wind electric techniques. Subscriptions to professional publications will allow access to information based on similar installations throughout the world. This documentary information will be supplemented by direct exchanges of correspondence between the project and similar programmes.

### **3. Details of training programme**

#### **Private company visits to the facilities of the supplier**

These visits concern the local small- and medium-scale companies: one trip for the director, and one for a skilled worker. The first visit will serve to define the parameters of a partnership and to visit other companies with a view to possible collaboration in the supplier's country or in neighboring countries. The second visit is a technical training stay for a skilled worker, allowing this individual to become familiar with the production methods of the northern partner.

#### **Team study trips**

These trips are aimed at allowing the team members to visit other rural electrification projects in neighboring countries. Trips are scheduled for Morocco, Senegal, and Mali for the two team members jointly. Two additional trips are scheduled to attend and/or participate in an international seminar. Also, each year, the Department of Energy engineer will spend one month at the Moules experimental base.

#### **On-the-job training**

Provision has been made for training sessions in specific fields, such as training for the use of computer software or English language courses, in Mauritania. An amount of US\$ 1,500 per team (GRET and DE) has been budgeted.

#### **Department of Energy team training**

Participation in two international seminars is scheduled each year for a government official. The project coordinator will also visit renewable energy suppliers and centres abroad. The Department of Energy engineer will spend one month a year at the Moules base in France. Finally, a scholarship fund will be set up to complement the training of Department of Energy personnel.

## Travel and Training Outside of Mauritania

### Personnel of the Department of Energy

|                              | Air Fare |               | Per diem   |               | Travel Exp.  | Total         |
|------------------------------|----------|---------------|------------|---------------|--------------|---------------|
|                              | No.      | USD           | No.        | USD           | USD          | USD           |
| <b>Year 1</b>                |          |               |            |               |              |               |
| Site visits                  | 1        | 1,600         | 10         | 2,000         | 1,000        | 4,600         |
| International seminars       | 2        | 4,100         | 18         | 3,600         | 500          | 8,200         |
| Study grants                 | 1        | 1,600         | 30         | 4,500         |              | 6,100         |
| Training at test facilities  | 1        | 1,600         | 30         | 6,000         | 800          | 8,400         |
| <b>Year 2</b>                |          |               |            |               |              |               |
| Site visits                  |          |               |            |               |              |               |
| International seminars       | 1        | 1,600         | 10         | 2,000         | 200          | 3,800         |
| Regional seminar             | 1        | 700           | 8          | 1,200         |              | 1,900         |
| Training at test facilities  | 1        | 1,600         | 30         | 6,000         | 800          | 8,400         |
| <b>Total - Years 1 and 2</b> |          |               |            |               |              |               |
| Site visits                  | 1        | 1,600         | 10         | 2,000         | 1,000        | 4,600         |
| International seminars       | 4        | 6,400         | 36         | 6,800         | 700          | 13,900        |
| Study grants                 | 1        | 1,600         | 30         | 4,500         |              | 6,100         |
| Training at test facilities  | 2        | 3,200         | 60         | 12,000        | 1,600        | 16,800        |
| <b>TOTAL</b>                 | <b>8</b> | <b>12,800</b> | <b>136</b> | <b>25,300</b> | <b>3,300</b> | <b>41,400</b> |

|                         |                   |
|-------------------------|-------------------|
| Total training activity | 4.5 person-months |
|-------------------------|-------------------|

### Project team personnel

|                              | Air fare |              | Per diem   |               | Travel Exp.  | Total         |
|------------------------------|----------|--------------|------------|---------------|--------------|---------------|
|                              | No.      | USD          | No.        | USD           | USD          | USD           |
| <b>Year 1</b>                |          |              |            |               |              |               |
| Site visits (Morocco, Mali)  | 2        | 2,500        | 18         | 3,600         | 1,500        | 7,600         |
| Visits abroad                | 2        | 2,500        | 46         | 9,200         | 1,500        | 13,200        |
| Training at test facilities  | 1        | 1,600        | 30         | 6,000         | 800          | 8,400         |
| <b>Year 2</b>                |          |              |            |               |              |               |
| Site visits                  |          |              |            |               |              |               |
| International seminars       |          |              |            |               |              |               |
| Training at test facilities  | 1        | 1,600        | 30         | 6,000         | 800          | 8,400         |
| <b>Total - Years 1 and 2</b> |          |              |            |               |              |               |
| Site visits                  | 4        | 5,000        | 64         | 12,800        | 3,000        | 20,800        |
| International seminars       |          |              |            |               |              |               |
| Training at test facilities  | 2        | 3,200        | 60         | 12,000        | 1,600        | 16,800        |
| <b>TOTAL</b>                 | <b>6</b> | <b>8,200</b> | <b>124</b> | <b>24,800</b> | <b>4,600</b> | <b>37,600</b> |

|                         |                   |
|-------------------------|-------------------|
| Total training activity | 4.1 person-months |
|-------------------------|-------------------|



### Private sector personnel

|                                    | Air fare |       | Per diem |       | Travel Exp. | Total |
|------------------------------------|----------|-------|----------|-------|-------------|-------|
|                                    | No.      | USD   | No.      | USD   | USD         | USD   |
| <b>Year 1</b>                      |          |       |          |       |             |       |
| Site visits to supplier facilities | 1        | 2,500 | 12       | 1,800 | 300         | 4,600 |
|                                    | 1        | 1,500 | 30       | 3,000 | 200         | 4,700 |
| <b>Year 2</b>                      |          |       |          |       |             |       |
| Total - years 1 and 2              |          |       |          |       |             |       |
| Site visits to supplier facilities | 2        | 4,000 | 42       | 4,800 | 500         | 9,300 |

|                         |                   |
|-------------------------|-------------------|
| Total training activity | 1.4 person-months |
|-------------------------|-------------------|

### Total International Training

|                      | Air fare |        | Per diem |        | Travel Exp. | Total    |
|----------------------|----------|--------|----------|--------|-------------|----------|
|                      | No.      | USD    | No.      | USD    | USD         | USD      |
| <b>Year 1</b>        |          |        |          |        |             |          |
|                      | 12       | 19,500 | 224      | 39,700 | 6,600       | 65,800   |
| <b>Year 2</b>        |          |        |          |        |             |          |
|                      | 4        | 5,500  | 78       | 15,200 | 1,800       | 22,500   |
| <b>Years 1 and 2</b> |          |        |          |        |             |          |
|                      | 16       | 25,000 | 302      | 54,900 | 8,400       | \$88,300 |

|                         |                   |
|-------------------------|-------------------|
| Total training activity | 9.9 person-months |
|-------------------------|-------------------|

## Annex 4

# MEMORANDUM OF UNDERSTANDING BETWEEN UNDP AND THE GOVERNMENT OF MAURITANIA

### *Unofficial Translation*

#### 1. Summary

The Government of Mauritania and the UNDP Country Office hereby agree on **National Execution** of the project. This project execution modality is an enhanced form of national execution as recently authorized by the UNDP Administrator. This new approach permits expanded UNDP Country Office (CO) support to the Government of Mauritania and to the project, including the direct procurement of services from participating NGOs.

Under this arrangement, the Government of Mauritania, acting through the Department of Energy, is responsible for project execution. Both the Government (Department of Energy, National Cell for Alternative Energy—CNEA) and the UNDP Country Office are responsible for implementation of defined project components as specified in the Project Document. In addition to UNDP Country Office support, UNDP Headquarters will provide assistance to the Country Office.

The UNDP Country Office is acting as one of the project implementation agencies at the request of the Government of Mauritania, and has agreed to assume this responsibility as described below. In its role as an implementing agency, the Country Office will contract directly with Government-approved NGOs to provide the services of these NGOs to the project. A project management plan has been worked out by Government and UNDP to assure close collaboration among Government, UNDP, and participating NGOs in all aspects of project implementation.

The framework and guidelines for the agreed-upon project execution modality are presented below. This signed memorandum of understanding is annexed to the Project Document.

#### 2. Framework for enhanced national execution

Under the provisions of the attached (Annex 1) UNDP Administrator's directive UNDP/PROG/93/5 dated 17 December, 1993 (*Direct Country Office Support to National Execution: Modification of Current Procedure*), it is possible to combine national execution of UNDP projects with an expanded and more decentralized role of the UNDP Country Office (CO). The Government of Mauritania, UNDP Headquarters, and the UNDP Country Office in Nouakchott have all agreed that the most effective project execution modality for the project is an enhanced form of National Execution that reflects the spirit and language of the above-referenced UNDP directive. Specific features of the enhanced mode of National Execution, as they pertain to this project, include the following:

##### 2.1 *Flexibility and responsiveness to project implementation requirements*

The newly authorized arrangements permit the Country Office to have an expanded role in nationally executed projects. This role includes the explicit authorization of UNDP Country Offices

to subcontract directly with participating NGOs and other institutions, and permits close coordination among UNDP, participating NGOs, and the Government.

## **2.2 *Financial provisions for expanded Country Office project support***

In all UNDP/GEF projects, the UNDP Country Offices are provided a budget of *up to 3%* of the total project cost to cover the costs of CO services on behalf of the project. Similarly, under the modified national execution modality chosen for this project, the UNDP Country Office will have a budget to cover the costs of its participation in the project. The guidelines under the modified government execution modality permit a nominal UNDP CO budget of *up to 3%* of the total project budget. However, additional funds may be required by the CO since no outside agency will be involved in project execution, and some of the tasks that would normally be the responsibilities of an outside agency will have to be assumed by the Country Office.

If there are specific essential activities that would require funds beyond the maximum overhead basis of 3%, these added costs are to be identified explicitly and added to the project budget as components of a new budget line item ("Country Office Support Services"). The additional funds are *not* to be shown as additional overhead above and beyond the 3% maximum, but are to be presented as explicit costs. The total CO support budget (overhead component and any additional costs) must be supported by budget projections based on specific activities and costs.

## **2.3 *Direct contract of NGO and other services by the UNDP Country Office***

The new UNDP guidelines for National Execution permit the UNDP Country Office to contract directly with NGOs and other institutions. In this project each participating NGO will have a separate contract directly with the UNDP Country Office. These contracts are annexed to the original Project Document, and are comprised of the detailed activities and products, schedules, full budgets, management plan, and key personnel for the NGOs. These elements have been reviewed and agreed to by Government, UNDP, and the NGOs. The total budgets for each NGO contract appear as single line items in the overall project budget presented in the Project Document.

## **2.4 *Expanded role of UNDP Headquarters***

Under the new execution modality, funds will be retained by UNDP/RBA/GEF to provide project technical and operational support and "backstopping" of the Country Office and to the Government of Mauritania in response to requests from either implementing agency. Support may include accessing the resources of the UNDP Office for Project Services (OPS), other United Nations institutions, and other relevant organizations on an as-needed basis. A budget equivalent to 3% of the total project budget is provided for this function. Unexpended funds will revert directly to the project.

# **3. *Specific provisions***

## **3.1 *Participation of NGOs in the project***

The Government has proposed the Groupe de recherche et d'échanges technologiques (GRET) as the principal implementing NGO, and UNDP Headquarters has approved a sole source procure-

ment of services from GRET by the UNDP Country Office. The Government also approves the participation of the national office of the NGO Société d'investissement et de développement international (SIDI) in the project.

UNDP will, on behalf of and at the request of the Government, engage NGOs, other organizations, and consultants, and will manage the associated contractual and financial aspects. If the Government has specific concerns regarding the performance of any contractor, this concern can be expressed both at the regular meetings of the Project Coordination Committee and at any other time if desired. The financial and contracting arrangements are essentially between UNDP and the contractors. However, the contractors are responsible for carrying out their responsibilities as specified in their contracts, which in turn reflect precisely the action plan of the Project Document. (See Section 11, page 4 of the UNDP Administrator's Memorandum of 17 December, 1993.)

### *3.2 Project management and implementation*

Each implementing agency (CNEA and the UNDP Country Office) will be responsible for the management and execution of their designated tasks, as well as for day-to-day coordination with their counterparts. Overall project coordination and monitoring will be facilitated by the Project Coordinating Committee. The Terms of Reference for the Project Coordinating Committee are provided in the original Project Document.

### *3.3 Independent scientific and technical oversight and support*

An independent Scientific and Technical Expert Committee of three to four persons will be convened by UNDP/GEF in consultation with the UNDP Country Office, the Government of Mauritania, and the participating NGOs. This committee will be made up of widely recognized experts in relevant fields such as decentralized renewable energy technologies for rural development, sustainable diffusion of renewable energy technologies, economics of rural energy supply, and integration of electrification with social and economic development. The purpose of the committee is to provide UNDP, the Government, and the NGOs with independent scientific and technical oversight, review, and support. Distinguished experts from both developing countries and OECD countries will be invited to participate in this committee.

The Terms of Reference for the committee are annexed to this Memorandum of Understanding. A budget equivalent to 3% of the total project budget is provided for this function. It is recommended that this activity be supported with a budget-line item for OPS, with direction from UNDP/GEF. Unexpended funds will revert directly to the project.

### *3.4 Project review and evaluation*

The standard UNDP procedures for project review and evaluation will be followed. The members of the Scientific and Technical Expert Committee (STEC) will annually conduct a mission of one to two weeks to review the project. This mission will also include national experts, and to the extent possible, will be held just before the annual Tripartite Review in order to permit a presentation of the mission's evaluation at this review.

### 3.5 *Key personnel*

The key GRET personnel (Project Director) will not be replaced without the approval of the Government or of the UNDP Country Office except in the case of *force majeure*. Similarly, the Government will not replace key national personnel (the two engineers of the Department of Energy associated with the project) without the approval of the UNDP Country Office except in the case of *force majeure*. The two implementing agencies will maintain their respective personnel throughout the duration of the project.

### 3.6 *Application of UNDP rules and regulations*

In the framework of the new arrangements concerning enhanced national execution, all the rules, procedures, and accords between the Government and UNDP shall be applicable, with two exceptions. In its function as a supporting agency for implementation,

- The UNDP Country Office will contract directly with GRET and will be responsible for all payments to GRET. The same arrangements will apply to all other contracts between the UNDP Country Office and other organizations within the framework of this project.
- The UNDP Country Office will organize and finance, using project funds allocated for this purpose, a financial and management audit of the activities of each organization involved in the project, including GRET and the Department of Energy.

### 3.7 *Payment arrangements*

Payment to both the Government and to participating NGOs will be made directly from UNDP, in conformity with UNDP's agreement with the Government for this project. Specifically, UNDP shall make an initial deposit and thereafter make deposits on an agreed upon regular basis to the Government's designated bank account and to each NGO's designated bank account, either in Mauritania or in the NGO's home country, according to a payment schedule drawn up after Government and UNDP approval of the overall budget and establishment of the subcontract between the Government and the participating NGOs. Each NGO will initiate requests for payment in accord with the requirements of UNDP, including provision of all required documentation and substantiation of expenditures authorized under the project. Copies of all payment requests and documentation to UNDP will be provided to Government.

### 3.8 *Financial audits*

Both the Government and each participating NGO shall individually maintain full financial records of project expenditures, and shall submit a summary of expenditures, with supporting documentation and justification, annually. An independent financial audit will be conducted annually. The Government may also request UNDP to arrange a special independent audit of participating organizations at any time during the project, for cause. The UNDP will be responsible for arranging

the annual independent outside financial audit of all participating institutions, in accordance with UNDP regulations and procedures.

### *3.9 Equipment procurement and international competitive bidding*

Equipment, materials, and services will be procured by the implementing agencies for the project. For procurements made by GRET, GRET shall make every effort to obtain the best prices for these procurements, subject to project requirements regarding quality and reliability, availability, quality of service and support, and time required for procurement and delivery. The UNDP Country Office will provide procurement services to GRET where this will result in less expensive or higher quality products and services.

For procurement of wind electric products and services, an international competitive bid (ICB) will be conducted. Government and the UNDP Country Office have concluded that the ICB should be managed by GRET. This is essential because the ICB will include not only equipment and related support services, but a request for participation of international suppliers of wind electric systems in local (Mauritanian) joint ventures, licensing agreements, training, and other technology transfer activities. However, to ensure that the ICB will reflect full international availability of equipment, services, and commercial participation, the ICB will be designed and conducted in collaboration with an independent internationally recognized organization in the field of small-scale wind energy technologies and in procurement of related products and services.

This collaboration will include identification of candidate companies for receipt of the ICB, design of the procurement announcement and details, and review and assessment of the responses. UNDP Headquarters will identify and nominate suitable organizations for this collaboration.

Nouakchott, April 21, 1994

## Annex 5

### ROLE AND RESPONSIBILITIES OF UNDP COUNTRY OFFICE<sup>7</sup>

|   |            |
|---|------------|
| <b>Overview</b> .....   | <b>113</b> |
| Introduction  |            |
| Principal responsibilities of Country Office                          |            |
| <b>Summary of Country Office GEF project support activities</b> ..... | <b>113</b> |
| <b>Description of Country Office activities</b> .....                 | <b>114</b> |
| Financial management and oversight                                    |            |
| Contract management   |            |
| Review of invoices, payment certification and arrangements            |            |
| Financial and management audits of GRET and Government                |            |
| Technical management and project oversight                            |            |
| Participation in Steering Committee and Coordination Committee        |            |
| Organization of annual Tripartite Review                              |            |
| Scientific and Technical Expert Committee (STEC)                      |            |
| Donor coordination  |            |
| Field visits and assessments by UNDP staff                            |            |
| Preparation of project reports  |            |
| Preparation of evaluation missions                                    |            |
| Arrangement of meetings and seminars                                  |            |
| Procurement   |            |
| Contract with GRET  |            |
| Oversight and procurement services                                    |            |
| Local Contracts Committee   |            |
| Logistic support  |            |
| International competitive bids  |            |
| Recruitment   |            |
| Expert consultants  |            |
| Review committees   |            |
| Preparation and coordination of expert missions                       |            |
| Scientific and Technical Expert Committee (STEC)                      |            |
| Approval of expert consultants for STEC                               |            |
| Mission of expert rural sociologists                                  |            |
| Expert consultants proposed by GRET                                   |            |
| <b>UNDP Country Office budget components</b> .....                    | <b>119</b> |

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<sup>7</sup> Under the provisions for UNDP-enhanced National Execution the UNDP Administrator's directive UNDP/PROG/93/5 *Direct Country Office Support to National Execution: Modification of Current Procedure* (17 December, 1993).

## **OVERVIEW**

### **Introduction**

This memorandum presents a provisional summary of Country Office activities envisaged under the UNDP-enhanced variant of National Execution. For Project Alizés-électrique, these include, but are not limited to, the activities described on the following pages. The activities described in this memorandum reflect the provisions of the 17 December, 1993, Memorandum of the UNDP Administrator (*Direct Country Office Support to National Execution: Modification of Current Procedure. UNDP/PROG/93/5*).

### **Principal responsibilities of Country Office**

The principal responsibilities of the Country Office in supporting Project Alizés-électrique under the enhanced National Execution modality include the following:

- Financial management and oversight
- Technical management and project oversight
- Procurement
- Recruitment
- Preparation and coordination of expert missions.

Each of these categories and the associated activities are presented in some detail below, and will be reviewed by both the Country Office and UNDP Headquarters. Finalization of the Country Office budget at the global level, with justification of major projected expenditures, are requirements for project approval by UNDP Headquarters.

## **SUMMARY OF COUNTRY OFFICE GEF PROJECT SUPPORT ACTIVITIES**

1. **Financial management and oversight**
  - 1.1 Contract management
  - 1.2 Review of invoices, payment certification and arrangements
  - 1.3 Financial and management audits of GRET and Government
2. **Technical management and project oversight**
  - 2.1 Participation in Steering Committee and Coordination Committee
  - 2.2 Organization of annual Tripartite Review
  - 2.3 Interaction with international Scientific and Technical Expert Committee (STEC)
  - 2.4 Coordination with potential donors
  - 2.5 Periodic field visits and assessments by UNDP staff
  - 2.6 Preparation of project reports as required
  - 2.7 Preparation of evaluation missions
  - 2.8 Arrangement of periodic meetings and seminars



### **3. Procurement**

- 3.1 Contract to procure services of GRET as principal implementing NGO
- 3.2 Oversight and procurement services as required on project-related procurements by GRET and Government
- 3.3 Local Contracts Committee
- 3.4 Logistic support
- 3.5 Review, advice, and oversight regarding the international competitive bids for procurement of goods and services from international wind electric systems suppliers

### **4. Recruitment**

- 4.1 Expert consultants (for field evaluations, audit reviews, etc.)
- 4.2 Review committees
- 4.3 Other

### **5. Preparation and coordination of expert missions**

- 5.1 Review, comment, and approval to Terms of Reference for Scientific and Technical Expert Committee (STEC)
- 5.2 Review and approval of expert consultants proposed by UNDP Headquarters and UNDP/Nouakchott for participation in the STEC (3-4 persons)
- 5.3 Review, comment, and assistance in coordinating mission of international expert rural sociologist
- 5.4 Review, comment, and approval of expert consultants proposed by GRET for project participation

## **DESCRIPTION OF COUNTRY OFFICE ACTIVITIES**

### **1. Financial management and oversight**

In addition to the usual financial management and oversight activities associated with the traditional form of national execution, the Country Office will have additional responsibilities, including management of the contract with GRET, review of invoices and arrangement for periodic payments to contractors, and the organization, financing, and oversight of financial and management audits of the contractors and of the Direction de l'énergie.

### **1.1 *Contract management***

The UNDP Country Office will maintain oversight of the activities of the contractors, and provide assistance to the contractors if matters of policy or procedure arise during project implementation. Contractors will be required to provide brief periodic (possibly monthly) progress letters in which activities, accomplishments, and problems are noted.

### **1.2 *Review of invoices, payment certification and arrangements***

The UNDP Country Office contractors (such as GRET) will submit invoices for payment on a regular basis, together with full documentation. All expenses are to be approved on the basis of consistency with the approved activities and budget line items for each contract, or on the basis of a special accord for a specific expenditure authorized by UNDP after signing of the contract. Payment will be made directly by UNDP to the contracting agencies. The details of the payment procedures will be incorporated in the contracts between UNDP and the contractors.

### **1.3 *Financial and management audits of GRET and Government***

For the first time under national execution, the Country Office will be able to *contract directly* for the financial and management audits of the Government and NGO implementing agencies. The Country Office will select an independent accounting firm to conduct the audits. (Government concurrence in the selection of the firm may be required.) These audits will be conducted on an annual basis, in accordance with standard UNDP procedures. A budget-line item to cover the costs of the four audits (two agencies, two years) is to be included in the overall Country Office budget for project-related activities.

## **2. *Technical management and project oversight***

Usual activities include participation by the UNDP Country Office in the Steering Committee and Coordination Committee, and the organization and convening of the annual Tripartite Review. Other traditional activities include preparation of project evaluation reports, and arrangement/hosting of meetings and seminars as required. In addition, for the new modality of execution, the Country Office will be in communication with the international Scientific and Technical Expert Committee, will arrange coordination with potential donors for financing of the follow-on phase of the project, and will participate in occasional field visits and on-site project assessments.

### **2.1 *Participation in Steering Committee and Coordination Committee***

The Country Office will be represented on both the Steering Committee (Comité de Pilotage) and the Coordination Committee (Comité de Coordination). The members of the Steering Committee will include senior representatives of UNDP/Nouakchott (Resident Representative), the Government (Minister of Water and Energy, Minister of Planning), and GRET. They will meet at least once a year (Tripartite Review Meeting). The Scientific and Technical Expert Committee (STEC) will be represented at the Tripartite Meeting, and senior representatives of interested donor agencies will be invited to participate.

The members of the Coordination Committee will include the UNDP programme manager responsible for the project, the Director of Energy (MHE), and the local GRET project manager. The committee will meet three to four times each year, and will focus on the operational aspects of the project, with a review of project progress, expenditures, and planned activities and expenditures for the next review period.

## *2.2 Organization of annual Tripartite Review*

The UNDP Country Office will organize and host the annual Tripartite Review meeting.

## *2.3 Interaction with international Scientific and Technical Expert Committee (STEC)*

The Country Office will maintain contact with the Coordinator of STEC, and will meet periodically with the STEC to review project activities and progress, and to identify specific areas where the STEC expertise and resources can be of assistance to the project.

## *2.4 Coordination as appropriate with potential donors*

The Country Office will inform potential donors (for financing of the second phase of the project) of project progress, and work to involve the donors in development of a plan and commitment for follow-on financing.

## *2.5 Periodic field visits and assessments by UNDP staff*

The Country Office programme manager responsible for oversight of Project Alizés-électrique will periodically visit field sites and participate in review of project activities. Other interested UNDP Country Office staff will be invited to visit project sites.

## *2.6 Preparation of project reports as required*

The Country Office programme manager will be responsible for the preparation of project reports as part of normal UNDP project oversight. Such reports will include the annual report of the Tripartite Review, reports of field missions and assessments, draft Terms of Reference for consultants and missions, and reports of meetings and seminars. (Note: GRET and the Government shall be responsible for the preparation of an Annual Report of the project for presentation at the annual Tripartite Review.)

## *2.7 Preparation of evaluation mission*

In collaboration with UNDP Headquarters, the Country Office will organize a mission of local and international experts to conduct an independent review and evaluation of the project. Both the Country Office and UNDP/HQ will nominate participants in this mission. Mission participants will include, but not be limited to, members of STEC.

## *2.8 Arrangement of periodic meetings and seminars*

From time to time there will be a need to arrange meetings and seminars. The UNDP programme manager for Project Alizés-électrique will be responsible for this, in collaboration with the other project participants. Such meetings may include: (i) review of specific project activities; (ii) presentations by project staff; (iii) presentations by visiting experts; and (iv) meetings to resolve specific problems or disputes.

### 3. Procurement

Under the new execution modality the Country Office has, for the first time, the authority to procure services on behalf of a nationally executed project. This includes procurement of the services of NGOs (such as GRET), consultants, equipment, and professional services.

#### 3.1 *Contract to procure services of GRET as principal implementing NGO*

The Country Office will negotiate and establish a contract with GRET for the services of GRET as the principal implementing NGO. This action will include the formulation of a model contract between a UNDP Country Office and an NGO, drawing on the experience of OPS with such contracts.

#### 3.2 *Oversight and procurement services as required on project-related standard procurements by GRET and Government<sup>8</sup>*

The Country Office will support GRET in procurement of equipment and services, as needed. The purposes of Country Office support are: (i) to obtain the best possible prices, using the United Nations procurement capabilities and arrangements (e.g., Inter-Agency Procurement Services Office—IAPSO in Denmark); and/or (ii) to expedite procurement of materials and services that are required quickly. For certain expensive items (such as vehicles and computer equipment), the Country Office may be able to save time, money, or both, by using the services of IAPSO.

Country Office support activities will include: (i) identification of qualified suppliers; (ii) issuance of requests for quotations on prices, delivery, terms and conditions of payment, warranties and guarantees, and local availability of authorized after-sales service (maintenance and repair), and (iii) evaluation of responses.

#### 3.3 *Local Contracts Committee*

A local UNDP Contracts Committee will be established, in accordance with existing UNDP procedures. Members will include the Deputy Resident Representative, the CO Administrator, the responsible Project Officer, and the CO Financial Officer. (See specifically paragraph 5 in the UNDP Administrator's Memorandum of 17 December,

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<sup>8</sup> Under the provisions for UNDP-enhanced National Execution the UNDP Administrator's directive UNDP/PROG/93/5 *Direct Country Office Support to National Execution: Modification of Current Procedure* (17 December, 1993).

1993—UNDP/PROG/93/5). The approval<sup>9</sup> of this committee is required for equipment costing \$30,000 or more.

### *3.4 Logistic support*

The Country Office will assist GRET and other contractors, as necessary, with in-country activities including customs clearance, warehousing in bonded (secure) facilities, and delivery arrangements with local transport agencies.

### *3.5 Review, advice, and oversight regarding the international competitive bids for procurement of goods and services from international wind electric systems suppliers*

The Country Office will work with GRET and an independent expert international organization in the development and execution of an international competitive bid (ICB) for the wind technology-related equipment and services required by the project. The UNDP shall be responsible for providing guidance on the United Nations system requirements for conducting an ICB.

## **4. Recruitment**

### *4.1 Expert consultants (for field evaluations, audit reviews, etc.)*

### *4.2 Review committees.*

## **5. Preparation and coordination of expert missions**

Several missions will take be organized by the UNDP Country Office in coordination with UNDP Headquarters, Government, and GRET. Related activities are the following:

### *5.1 Review, comment, and approval to Terms of Reference for Scientific and Technical Expert Committee (STEC)*

### *5.2 Review and approval of expert consultants proposed by UNDP/HQ and UNDP/Nouakchott for participation in the STEC (three to four persons)*

### *5.3 Review, comment, and assistance in coordinating mission of international expert rural sociologist*

### *5.4 Review, comment, and approval of expert consultants proposed by GRET for project participation*

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<sup>9</sup> Under the provisions for UNDP-enhanced National Execution the UNDP Administrator's directive UNDP/PROG/93/5 *Direct Country Office Support to National Execution: Modification of Current Procedure* (17 December, 1993).

## **UNDP COUNTRY OFFICE BUDGET COMPONENTS**

For each task/activity, the UNDP Country Office will incur costs including Country Office staff time and an array of direct costs. The cost categories are summarized below. The Country Office budget for direct project-related support has been established on the basis of the tasks and cost components for each task.

### **1. Labor costs (fully burdened)**

- 1.1 Professional staff
- 1.2 Administrative staff
- 1.3 Support staff
- 1.4 Temporary staff
- 1.5 Local consultants
- 1.6 Other

### **2. Mission-related costs**

- 2.1 Consultant fees
- 2.2 International travel
- 2.3 Domestic and local travel
- 2.4 Per diem
- 2.5 Misc. mission costs

### **3. Direct costs (operating)**

- 3.1 Possible international travel for UNDP staff
- 3.2 Local travel (vehicles, chauffeurs)
- 3.3 Per diem (UNDP staff domestic travel)
- 3.4 Fax, telex, and electronic mail
- 3.5 Postage
- 3.6 Telephone
- 3.7 Courier (such as DHL)
- 3.8 Supplies (stationery, transparencies, software, diskettes, etc.)
- 3.9 Equipment maintenance
- 3.10 Photocopies
- 3.11 Printing and binding
- 3.12 Report preparation
- 3.13 Journals, books, reports, etc.
- 3.14 Translation services (French/Arabic/English)
- 3.15 Other

### **4. Direct costs (capital equipment)**

- 4.1 Computer
- 4.2 Printer
- 4.3 Telephone
- 4.4 Office furnishings
- 4.5 Other

Scenario 3 – National Program Officer  
plus Int'l Prof. Staff support

| Scenario 3 – National Program Officer<br>plus Int'l Prof. Staff support |                       | Year 1     |       |                       | Year 2     |       |                       | Years 1+2  |       |          | Total US\$ |
|---|-----------------------|------------|-------|-----------------------|------------|-------|-----------------------|------------|-------|----------|------------|
| Category  | Labor (person – days) |            |       | Labor (person – days) |            |       | Labor (person – days) |            |       |          |            |
|   | Prof. Int.            | Prof. Lcl. | Staff | Prof. Int.            | Prof. Lcl. | Staff | Prof. Int.            | Prof. Lcl. | Staff |          |            |
| 1. Financial mgmt/oversight   | 11                    | 64         | 15    | 11                    | 64         | 15    | 22                    | 128        | 30    | 12,989   |            |
| 1.1 Contract management   | 6                     | 30         | 6     | 6                     | 30         | 6     | 12                    | 60         | 12    | 6,477    |            |
| 1.2 Financial management  | 4                     | 24         | 6     | 4                     | 24         | 6     | 8                     | 48         | 12    | 4,823    |            |
| 1.3 Financial/management audits   | 1                     | 10         | 3     | 1                     | 10         | 3     | 2                     | 20         | 6     | 1,688    |            |
|   |                       |            |       |                       |            |       |                       |            |       | 0        |            |
| 2. Technical management/oversight                                       | 16                    | 130        | 36    | 22                    | 130        | 36    | 38                    | 260        | 72    | 24,911   |            |
| 2.1 Committees  | 4                     | 30         | 5     | 4                     | 30         | 5     | 8                     | 60         | 10    | 5,401    |            |
| 2.2 Tripartite Review   | 1                     | 10         | 4     | 1                     | 10         | 4     | 2                     | 20         | 8     | 1,734    |            |
| 2.3 STAC  | 1                     | 10         | 5     | 1                     | 10         | 5     | 2                     | 20         | 10    | 1,779    |            |
| 2.4 Donor coordination  | 2                     | 15         | 3     | 6                     | 15         | 3     | 8                     | 30         | 6     | 3,754    |            |
| 2.5 Field visits  | 2                     | 12         | 6     | 2                     | 12         | 6     | 4                     | 24         | 12    | 2,547    |            |
| 2.6 Project reports   | 0                     | 15         | 5     | 1                     | 15         | 5     | 1                     | 30         | 10    | 2,040    |            |
| 2.7 Evaluation missions   | 0                     | 8          | 3     | 1                     | 8          | 3     | 1                     | 16         | 6     | 1,223    |            |
| 2.8 Meetings and seminars   | 6                     | 30         | 5     | 6                     | 30         | 5     | 12                    | 60         | 10    | 6,432    |            |
|   |                       |            |       |                       |            |       |                       |            |       | 0        |            |
| 3. Procurement  | 5                     | 45         | 31    | 4                     | 45         | 25    | 9                     | 90         | 56    | 8,254    |            |
| 3.1 Contract with GRET  | 2                     | 5          | 5     | 0                     | 5          | 1     | 2                     | 10         | 6     | 1,170    |            |
| 3.2 Procurement oversight   | 0                     | 10         | 5     | 1                     | 10         | 5     | 1                     | 20         | 10    | 1,521    |            |
| 3.3 Local contracts committee   | 1                     | 5          | 3     | 1                     | 5          | 3     | 2                     | 10         | 6     | 1,170    |            |
| 3.4 Logistic support  | 0                     | 15         | 15    | 2                     | 15         | 15    | 2                     | 30         | 30    | 2,750    |            |
| 3.5 ICB support   | 2                     | 10         | 3     | 0                     | 10         | 1     | 2                     | 20         | 4     | 1,644    |            |
|   |                       |            |       |                       |            |       |                       |            |       |          |            |
|   |                       |            |       |                       |            |       |                       |            |       |          |            |
| 4. Recruitment  | 1                     | 6          | 2     | 2                     | 6          | 2     | 3                     | 12         | 4     | 1,486    |            |
| 4.1 Expert consultants  | 1                     | 3          | 1     | 1                     | 3          | 1     | 2                     | 6          | 2     | 872      |            |
| 4.2 Review committees   | 0                     | 3          | 1     | 1                     | 3          | 1     | 1                     | 6          | 2     | 614      |            |
|   |                       |            |       |                       |            |       |                       |            |       |          |            |
| 5. Expert Missions  | 2                     | 15         | 8     | 0                     | 15         | 8     | 2                     | 30         | 16    | 2,433    |            |
| 5.1 STAC Terms of Ref.  | 0                     | 2          | 1     | 0                     | 0          | 1     | 0                     | 2          | 2     | 149      |            |
| 5.2 STAC consultants  | 0                     | 1          | 1     | 0                     | 3          | 1     | 0                     | 4          | 2     | 253      |            |
| 5.3 Mission: sociologist  | 1                     | 10         | 5     | 0                     | 10         | 5     | 1                     | 20         | 10    | 1,521    |            |
| 5.3 GRET consultants  | 1                     | 2          | 1     | 0                     | 2          | 1     | 1                     | 4          | 2     | 510      |            |
|   |                       |            |       |                       |            |       |                       |            |       |          |            |
| Total person – days   | 35                    | 260        | 92    | 39                    | 260        | 86    | 74                    | 520        | 178   | \$50,074 |            |
| Total labor cost (US \$)  | 9,019                 | 13,493     | 2,077 | 10,050                | 13,493     | 1,942 | 19,069                | 26,985     | 4,019 | \$50,074 |            |

Projected annual direct costs

| Direct Costs                   | UG  | US\$   | Number | Annual Total \$ | Project Total \$ |
|--------------------------------|-----|--------|--------|-----------------|------------------|
|                                |     | 0.00   |        | 0               | 0                |
| International fax per page     | 500 | 4.03   | 200    | 806             | 1,613            |
| e-mail (per page)              | 250 | 2.02   | 400    | 806             | 1,613            |
| Telephone to U.S. (per minute) |     | 10.00  | 120    | 1,200           | 2,400            |
| Photocopies (per page)         | 20  | 0.16   | 10,000 | 1,613           | 3,226            |
| DHL (per shipment)             |     | 100.00 | 12     | 1,200           | 2,400            |
| Local transport for experts    |     | 22.00  | 20     | 440             | 880              |
| TOTAL                          |     |        |        | \$6,066         | \$12,132         |

Extraordinary Project Costs

| Component                   | Year 1 | Year 2 | Total    |
|-----------------------------|--------|--------|----------|
| Financial/management audits | 5,000  | 5,000  | 10,000   |
| Other (specify)             | 2,000  | 4,000  | 6,000    |
|                             |        |        |          |
|                             |        |        |          |
|                             |        |        |          |
| TOTAL                       | 7,000  | 9,000  | \$16,000 |

Country Office Budget Summary (Alizes/electrique)

| Component                   | Year 1 | Year 2 | Total    | % total |
|-----------------------------|--------|--------|----------|---------|
|                             |        |        |          | 0.0%    |
| Labor                       |        |        | \$50,074 | 2.6%    |
| Direct Costs                | 6,066  | 6,066  | \$12,132 | 0.6%    |
| Extraordinary project costs | 7,000  | 9,000  | \$16,000 | 0.8%    |
|                             |        |        |          | 0.0%    |
| TOTAL                       |        |        | \$78,205 | 4.1%    |