



## PROJECT CONCEPT AND REQUEST FOR PDF BLOCK B GRANT

Country	Cuba
Title	Generation and delivery of renewable energy based modern energy services in Cuba; the case of Isla de la Juventud
GEF focal area	Climate change
GEF operational programme	OP 6 – Promoting the adoption of renewable energy
Requesting agency	UNIDO (Executing Agency with Expanded Opportunities)
National counterpart agency	The Centre for Management of Priority Programmes and Projects (GEPROP) of the Science and Technology Agency under the Ministry of Science, Technology and Environment
Estimated starting date	September 2001
Total PDF funding required:	US\$ 455,000
• GEF Block-B funding requested	US\$ 325,000
• Co-funding of PDF activities:	US\$ 130,000
- UNIDO	US\$ 50,000 (cash)
- Government of Cuba	US\$ 80,000 (in kind)
Block-A grant awarded:	None
Duration:	12 months
Eligibility:	Cuba ratified UNFCCC on 05 January 1994

## 1. Background

### 1.1 Overview of energy sector in Cuba

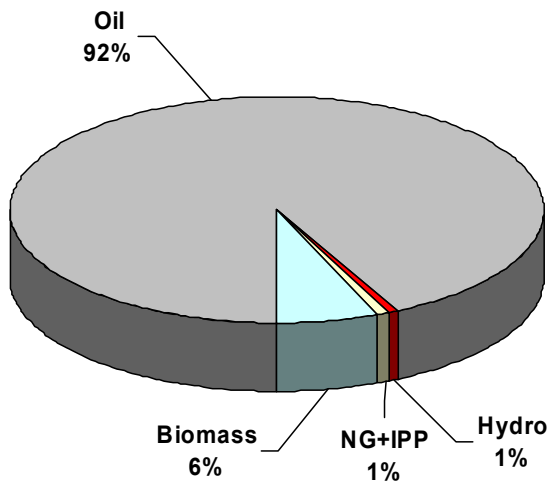
Since the beginning of 90s, Cuba has been in a critical period of national development caused by the sudden collapse of commercial and financial relations with the former COMECON economies along with the reinforcement of the economic, financial and trade embargo that the country is facing. In addition, the Cuban industry and energy sectors are built around imported fuel. Due to the abrupt fall of its Gross Domestic Product and the lack of hard currency, fuel imports have declined from 13 million tons in 1989 to slightly more than 6 million in 1998 (with an additional national production of nearly 2 million tons). This situation has provoked an intense energy deficit, which has had a strong negative impact on the country's economic structure and population. The importance of fuel oil for Cuba can be appreciated in Table I and accompanying chart which present 1998 estimates of the country's installed power capacity and generation by type of fuel.

**Table I: Installed Capacity and Generation in National Electric System (NES) of Cuba, 1998**

Source	Installed capacity, MW	Generation, MWh	Percentage of Total Generation
<b>Fuel-oil</b>	3,124	12,671,564	92.5
<b>Hydroelectric</b>	60	86,364	0.6
<b>Natural Gas + IPP</b>	170	90,338	0.7
<b>Biomass</b>	684	850,431	6.2
<b>TOTAL</b>	<b>4,038</b>	<b>13,698,697</b>	<b>100.0</b>

### 1.2 Government energy policy

Given the general shortage of energy in the country and the fact that about 75 percent of Cuba’s total fuel-oil consumed is imported, in addition to the positive implications of using renewable energy for the local and global environment, exploring this alternative source of energy has been given high priority. In 1993, the National Parliament approved the National Energy Sources Development Programme where the efficient use of the country’s natural resources (biomass, wind, solar, hydro) for the production of energy is given top priority in terms of development efforts.



In 1998, over 90 percent of Cuba’s electricity generation capacity was oil-fired. Currently, Cuba

produces 50 percent of its oil demand. The other 50 percent is imported. The economic crisis forced the Government to restrict oil imports, producing widespread electricity shortages, which have been minimized to the present. The Government’s National Energy Programme places a high priority on the development of indigenous and environmentally-benign resources for electricity generation, including biomass, wind, solar and small hydro resources, in order to alleviate electricity shortages, reduce oil imports and preserve the environment for tourism.

The Cuban Government is promoting foreign investment in those areas in which capital and technological innovation are most needed. The electric power generation sector is among the targeted areas. Various forms of economic association, such as joint ventures, can be employed for this purpose. The legal conditions for foreign investment are established in the Law 77 on Foreign Investment published in September 1995. Furthermore, Article 23 of the Constitutional Reform Law approved in July 1992 states that the Government will respect the property of the joint ventures and other economic associations set up under the law.

### 1.3 Linkage to other GEF funded past, ongoing, planned renewable energy based activities

Currently, in Cuba, a number of GEF funded renewable energy based activities are under implementation. The here proposed initiative has been designed to complement these activities and to build on their outcomes to the extent possible. Overlaps have been avoided at the design stage and during the implementation the other initiatives will be closely monitored as to make full use of project outcomes,

complement their activities and again to avoid overlaps. It concerns the following past, ongoing, planned initiatives:

- **Full-scale project – “Co-generation of Electricity and Steam Using Sugarcane Bagasse and Trash.”** This project aims at reducing Cuba’s energy-related CO<sub>2</sub>-emissions by removing barriers to the substitution of sugarcane bagasse and trash for fuel oil in power and steam co-generation. This will be achieved by demonstrating the technical, economic and financial viability to establish companies in the vicinity of sugar mills to co-generate steam and power by using biomass-fired high-pressure condensing-extraction steam turbine technology. By demonstrating the technology and reducing the barriers to its large-scale replication, it is expected that a significant fraction of the biomass energy potential in Cuba can be harnessed in an efficient way. In the medium-term, it is estimated that some 3,000 GWh/yr of additional biomass-based power can be supplied to the grid thus reducing annual carbon emissions by over 600,000 tC;
- **Medium-size project – “Cuba Small Hydro Development.”** Cuba has exploited only 5 percent of its estimated 350 MW of small hydro potential. This project aims to increase small hydro development in order to reduce widespread electricity shortages. It would achieve this goal by removing barriers to small hydro development, specifically in the areas of information, human capabilities and technology improvements;

In 2000, UNIDO commissioned a pre-feasibility study to assess the potential of renewable energy resources for the provision of modern energy services at the Isla de la Juventud. The outcome resulting from this pre-feasibility study serves as the basis for the here proposed initiative. In addition, over the past years, the UNIDO’s Industrial Energy and Climate Change Branch has had multiple consultations with Cuban stakeholders on the development of sustainable energy, including both energy efficiency and renewable energy.

## **2. GEF alternative**

### **2.1 Problem statement**

Provision of electricity to all households, services and industries is the aim of the Government of Cuba. On the Isla de la Juventud, this target has been achieved by mini- and micro-grids supplied by diesel generators. The remaining energy use in the Island is also oil-based. The rapid expansion of tourism and activities in the related services in the Island is causing large increases in the energy demand. Expanding the diesel-based electricity generation is not sustainable, both economically (most of oil is imported) and environmentally. The estimated renewable energy resources of the Island are sufficient to replace the fossil fuels used in electricity generation and some of the non-power applications. Therefore, replacing diesel generators by renewable energy-based supply systems is the selected route to achieve sustainability.

### **2.2 Project focus area: Mini-grid replacement and Isla de la Juventud**

The proposed initiative focuses on the replacement of diesel generator supplied mini-grids with renewable energy alternatives. Diesel electricity is rapidly expanding in developing countries in general and in rural areas in particular. The initial (pilot, demonstration) phase will be implemented on the Isla de la Juventud from where the replication to the mainland of Cuba will be designed and undertaken. Further, it is planned to expand the project to other Caribbean countries. “Suggested Principles for GEF Assistance for Mini-Grids and Hybrid Systems” were taken into account in designing this project (see section 2.4 GEF

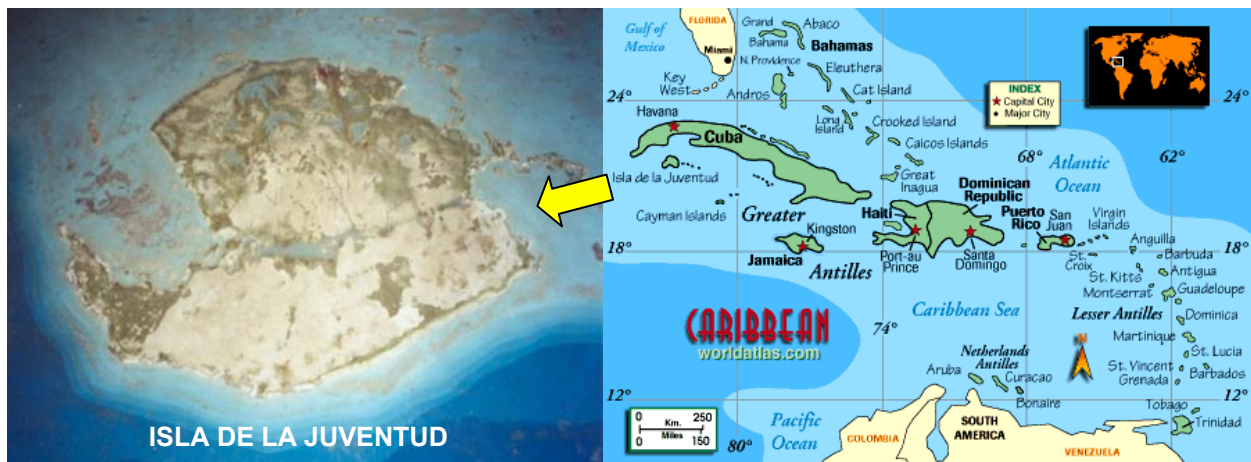
alternative.) The Government of Cuba has selected this focus area based on a number of criteria among others:

- the availability of a variety of natural resources to be used for the generation of modern energy services (biomass, solar, wind and hydro);
- the need for an increased and improved provision of modern energy services;
- to reduce the costs of modern energy services by making use of locally available resources,
- the need to reduce full reliance on imported (from the mainland/international sources) fossil fuels for electricity generation, transport and industrial/household heat energy requirements;
- the availability of a good (R&D/implementation) infrastructure to undertake activities as outlined in this proposal; and
- a controlled environment, reasonably close to Havana to design and implement pilot and demonstration projects prior to upscaling and replication to the Cuba mainland.

### 2.3 Baseline

The Isla de la Juventud is the second island in the extension of the Cuban archipelago formed by more than 2000 islands and keys. The island has a population of approximately 85,000, with almost 92 percent of this population living in urban areas and 8 percent living in rural areas. The annual population growth rate is 1.6 percent. Main economic activities are fishing, agriculture, in particular citrus, banana and pig farming, and the ceramics industry. Tourism is also beginning to increase on the island and a number of new economic activities for the local population are starting to develop. These new activities however, will likely lead to increases in the demand for energy. The island possesses a number of natural and renewable resources that could be utilized in the production of energy. These are mainly biomass from forest products and organic residues, hydroelectricity, wind power located along the east and south coast and solar energy for thermal generation. At present the island's electrical generating capacity is totally based on the combustion of fossil fuels (mainly diesel).

As of 2000, the island's installed electricity generation capacity was totally diesel-based. Electricity generation accounts for 54 percent of the island's primary energy use and 50 percent of energy imports. Three diesel power plants, 3 MW each, supply the mini-electrical grid, which covers 99 percent of the island's population with only the village of Cocodrilo not being connected to the grid. The residents of Cocodrilo are supplied with electricity for several hours per day produced from two 370 kW diesel generators.



The remaining 46 percent of total primary energy use (42 percent of imports) is consumed by the following: 23 percent by transport, with 15 percent in the form of diesel for trucking activities and 8 percent in the form of gasoline for use in private cars. A further 6 percent is used in the form of fuel and diesel oil to fuel industrial boilers and cookers. An additional 6 percent is consumed by the residential sector in the form of LPG for cooking. The residential sector also consumes the only renewable resources presently utilized on the island in the form of fuel wood and charcoal (4 percent). The remaining 7 percent is consumed by other industrial and agricultural uses. In total the residential sector accounts for 29 percent of the islands primary energy consumption, including 34 percent of the total amount of electricity generated. The island's distribution of energy consumption by economic sectors is as follows; industrial sectors 30 percent, transport sector 23 percent and agricultural sector 16 percent. The cost of diesel-based power is very high (around 10 US¢/kWh), making it expensive for economic activities.

There is an active Government policy to assist Isla de la Juventud to explore and exploit their natural resources to generate and deliver modern energy services as to reduce reliance on (expensive) fossil fuels for electricity generation, transport, industrial and domestic heat requirements. There exist however a number of barriers that prevent this process to take off in a substantive manner, hence the request for assistance from GEF to study these barriers and to design a full-scale programme that addresses these barriers resulting in increased use of renewables for the generation of modern energy services on the Isla de la Juventud; later on to be replicated to the Cuba mainland and possibly the Caribbean region after its successful introduction.

## **2.4 Barriers**

The earlier mentioned pre-feasibility study funded by UNIDO in combination with various rounds of consultations organized and coordinated by UNIDO with representatives from the national counterpart agency for this initiative, “The Centre for Management of Priority Programmes and Projects (GEPROP) of the Science and Technology Agency under the Ministry of Science, Technology and Environment” the following barriers were identified:

### **2.4.1 Financial barriers**

- The high capital cost of renewable energy products and projects is a main barrier to the increased use of renewable energy sources for the provision of modern energy services;
- No dedicated financing for renewable energy activities exists with financial institutions and the capacity within financial institutions and power utilities to appraise renewable energy proposals is limited or non-existing;
- Government budgets are limited and the demand for financing various national priority areas is great;
- The currently small and dispersed size of the Cuban renewable energy market does not facilitate benefits such as economies of scale.

### **2.4.2 Institutional barriers**

- UNE (the National Utility) depends on the national budget for implementation of activities, which creates uncertainties in allocation of project financing as well as time delays;
- Renewable energy based provision of modern energy services is dealt with by various ministries, agencies and institutions, making good coordination between them a necessity to efficiently make use of limited human and financial resources in this area. Also this is subject to improvement;
- Severe regulatory hurdles exist for private non-state run electric company entities who may wish to enter the power supply system;
- Limited spatial distribution of suppliers limits access to renewable energy technologies.

### 2.4.3 Technical barriers

- Bulk procurement of renewable energy technologies is limited due to the current small market for renewable energy based modern energy services. Hence the (technical) infrastructure to support renewable energy development does not exist;
- Local manufacturing and/or assembly of renewable energy technology components is currently mostly lacking, although the knowledge, skills, expertise and facilities are available in Cuba;
- Limited technical capacity to design, install, operate, manage and maintain renewable energy based modern energy services, mainly as a result of lack of past activities in this (new) field;
- The technical skills, including conclusive data comparing energy technologies for equivalent energy services, is limited;
- Norms and standards in terms of renewable energy performance, manufacture, installation and maintenance are weak and/or non-existing.

### 2.4.4 Information and human resource barriers

- Availability and access to existing renewable energy resource information is limited. A central information point does not exist, instead information is scattered among various sectors; e.g. public sector, development assistance, R&D centres and academia;
- Availability of renewable energy resources is very site specific, requiring detailed analysis of the local specific conditions;
- Limited knowledge on the renewable energy market potential;
- There is lack of public awareness on renewable energy technologies other than that they exist. Knowledge on for example the fact that life cycle costs of renewable energy technologies are often competitive or even lowest cost options is mostly absent;
- Little empirical knowledge of the costs and benefits of the range of technologies available for providing renewable energy based modern energy services exists and thus it has not been extended to policy and decision makers;
- Limited in-country capacity for renewable energy data collection and analysis;
- Limited in-country capacity for renewable energy project development.

## 2.5 GEF alternative

### 2.5.1 Overall project objective

Renewable energy will be one of the means of providing energy to isolated and/or rural communities so that they can improve their living standards and increase their income. For that purpose, either renewable energy will replace diesel fuel in mini-grids or it will be the main energy source for new grids. Renewable energy generation and distribution will be carried out by public and private companies (such as joint ventures, BOT projects) as promoted by the foreign investment laws of Cuba.

Therefore, this project will identify, evaluate and prioritize the barriers preventing increased uses of renewable energy sources for the provision of modern energy services and to design activities for their reduction/removal.

## 2.5.2 Specific objectives of the PDF Block B phase

In particular, PDF Block B activities will identify, evaluate and design meaningful avenues to reduce/remove financial, institutional, technical, information and human resource barriers hampering the increased use of renewable energy sources for the provision of modern energy services such as electricity, transport and heat requirements in industrial and domestic sectors. Further it will identify requirements and develop a full-scale proposal that supports the development of renewable energy based provision of modern energy services in Cuba. Initial activities will focus on the Isla de la Juventud, from where replication activities will be designed for implementation on the mainland of Cuba and possibly other countries in the Caribbean.

## 2.5.3 Project components

The components of the full-scale project will, among others, address the “Suggested Principles for GEF Assistance for Mini-Grids and Hybrid Systems.” Following components will be implemented in the main phase:

### *Information/policy/planning component*

- Establish and maintain a renewable energy information system, including a complete package to facilitate replications.
- Assist with government policies to promote mini-grids and hybrid systems, such as: (i) integration into rural development programs; (ii) identification and provision of levels of public subsidies equivalent to those given to grid-connected consumers; (iii) mechanisms to put renewable energy on a more equal basis with diesel fuel if the diesel is subsidized; and (iv) business incentives and other forms of support for cooperatives and/or project developers.
- Assist with planning mechanisms that treat mini-grids, off-grid systems (i.e., solar home systems) and central grid extension in an integrated fashion that delineates the proper role and geographical base of each type of application within an overall framework of providing rural electricity access.

### *Capacity building component*

- Provide pilot installations that are designed to test, monitor and evaluate the following types of experience:
  - Technical operating characteristics
  - Validity of pre-project resource assessment methodologies
  - Requirements and costs of maintenance
  - Incremental costs of renewable energy sources relative to diesel (for hybrids)
  - Institutional/business models for financing, ownership, operations, and billing
  - Social/policy arrangements for connections, tariffs, non-payments, consumption allocation
  - Social welfare and economic benefits
  - Roles and potential contributions of non-governmental and community organizations
- Establish financing mechanisms that are appropriate to the likely delivery models in a given context (i.e., cooperative association, private power developer, etc.) and educate financiers about mini-grid and hybrid investments.
- Validate sustainable business models for mini-grid and hybrid system development, operations, and maintenance that can be replicated given quantified inputs like social subsidies.
- Strengthen the Counterpart’s programme management capabilities.

### ***Technology/market development and replication component***

- Provide technical, business and financial training for system developers/owners/operators.
- Educate consumers about the constraints and characteristics of mini-grids or hybrid systems to enable informed and appropriate social/policy arrangements for connections, tariffs, non-payments, and consumption allocation.
- Assist communities and entrepreneurs to develop income-generation activities (i.e., small industry) in conjunction with mini-grid and hybrid system development.

#### **2.5.4 Estimated project cost**

Co-financing for the full-size programme (typically 4-6 years) is expected to come mainly from bi- and multilateral donors active in Cuba (estimated US\$ 2-3 million), from investors/developers (estimated US\$ 3-5 million) and from the Cuban Government (an estimated US\$ 3-4 million; cash and in-kind combined), but is not necessarily limited to this. Anticipated GEF financing for the full-scale project ranges from US\$ 2-5 million. Hence the total size of the full-scale programme is estimated to range from US\$ 10-17 million. The numbers mentioned here are very preliminary and should be looked upon as a very rough first estimate only, since the PDF B activities will focus on detailing these numbers.

#### **2.5.5 Project execution**

For the GEF, UNIDO is the executing agency with expanded opportunities, whereas the national counterpart agency is the Centre for Management of Priority Programmes and Projects (GEPROP) of the Science and Technology Agency under the Ministry of Science, Technology and Environment. A local Programme Management Unit (PMU) will be set-up and staffed at GEPROP.

A Project Steering Committee (PSC) will be set up to advise UNIDO and GEPROP on the direction of project development and implementation.

#### **2.5.6 Project stakeholders**

The stakeholders of the project will be, among others:

- Energy consumers of Cuba in general and those of the Island in particular;
- Government, through the Ministry for Science, Technology and Environment, in close cooperation with the Union Electrica, the state power utility;
- National organizations/universities/banks/firms operating in investment, research, equipment supply, operation and maintenance, training, etc.;
- Provincial and district administrations:
  - Juventud Island Administration Council, headed by the President of the Municipal Assembly;
  - Local electric utility;
  - Local environmental authority;
  - Direction of Planning, in charge of the energy balance in the island;
  - Local tourist authorities;
  - Technical Advisory Council on Energy.
- Local companies:
  - Forestry company;
  - Producers of agricultural wastes, such as the pig farms and citrus processing enterprises;
  - Electric energy producer of the Island;
  - Enterprises that use fuel oil for power generation and heating, such as citrus plant;
  - Ceramic factory, fish processing factory, etc.



### 2.5.7 Sustainability and replicability

The sustainability and replicability of this project are especially strong because:

- The project is a part of the Government's drive to promote renewable energies.
- Public and entrepreneurial partnerships in Cuba has been changing very positively:
  - Since the early 90s Cuba has been fine-tuning its economic policy to the needs of the nation and has set a number of measures to engage foreign enterprises in the local production of goods and services. Initiatives in nickel, hotels, tourism, trade, oil exploration and exploitation, steel making, dairy, garment and electricity generation have already been implemented with the participation of foreign companies. The Ministry for Investment and International Cooperation is actively promoting new investment opportunities abroad.
  - One of the most important measures was the introduction of the law for the Promotion and Protection of the Foreign Investment, to support associations between Cuban and foreign partners, by means of joint venture companies as well as by economic contracts. The energy sector is included among the economic areas authorized for foreign partnerships and some initiatives have already been implemented: a gas-powered generation plant by means of a joint venture company; a BTO contract for diesel-power generation in Juventud Island; risk contracts for off-shore petroleum exploration, etc.
  - Another measure was the introduction of the regulation that allows enterprises to pay for their energy bills in hard currency. The price for electricity and fuels for enterprises are calculated by adding the cost of the imported fuel to the cost to processing (refining) it in the country. This is the basis for the local promotion of energy saving measures and for calculating the price for Energy Services Companies in the country. Energy subsidies are only granted to the residential consumers and to some public services like the health and education systems.
- Replication from Juventud to the main island is easily achievable
  - It is expected that upgrading/replacing the mini-grids in Isla de la Juventud will create an important opportunity in rural electrification in mountain regions of the mainland, where it is estimated that there are around 100,000 houses with no access to electricity.
  - The experience with power production with forestry biomass using advanced technology could be replicated in the mainland, especially in remote regions where small forestry plantations could be managed. The generation of electricity from forest biomass could also be adopted by the sugar industry in the months after the bagasse season. The sugar industry is the main potential renewable power producer in the country. The local demonstration of technologies for the use of forestry biomass in replacement of fossil fuels will support the development of a program for the use of sugar cane bagasse and residues.
- Replication to the Caribbean countries is possible:
  - The Caribbean islands have energy problems that are similar to each other. National markets are small, technology and equipment are inefficient and, except for Trinidad and Tobago, depend heavily on imported fuel.
  - The dimensions of most of the Caribbean islands are similar to Juventud Island, so the renewable energy solutions, such as the of management mini-grid systems based on renewable energy, will be easily replicable. Cuba is part of the group of countries that have created a Regional Energy Technology Center now being developed for the region. It is expected that the Center will take part in replicating Juventud's results to the other countries of the region.

Sustainability will be addressed in the design of each component of the project. The experience of UNIDO in the rural development programmes in general and rural energy projects in particular will also be utilized to achieve sustainability and replicability.



### **3. Justification of the PDF grant**

#### **3.1 Country eligibility**

The Government of Cuba ratified the United Nations Framework Convention on Climate Change (UNFCCC) in January 1994. The Government has an Energy Plan and actively supporting energy-sector investments in general and joint ventures in particular. There are a number of active energy and environment-related projects financed by multilateral and/or bilateral donors. In addition, Cuba is a UNIDO member country.

#### **3.2 Relevant GEF Operational Programme**

The proposed project is consistent with the GEF Climate Change Operational Programme OP 6 “Promoting the adoption of renewable energy by removing barriers and reducing implementation costs.” It also constitutes a part of the Government plans and strategies to increase the share of renewable energies in the country’s energy mix with a view to improve sustainability and energy security.

Furthermore, the project takes into account the “Suggested Principles for GEF Assistance for Mini-Grids and Hybrid Systems.” These principles include, among others:

- Provide pilot installations that are designed to test, monitor and evaluate the different types of experience;
- Establish financing mechanisms;
- Validate sustainable business models;
- Assist with government policies to promote mini-grids and hybrid systems;
- Assist with planning mechanisms that treat mini-grids, off-grid systems;
- Provide technical, business and financial training for system developers/owners/operators;
- Educate consumers about the constraints and characteristics of mini-grids;
- Assist communities and entrepreneurs to develop income-generation activities.

#### **3.3 Rationale for PDF support**

Based on the identified barriers (see 2.3), it is necessary to design each one of the project components (see 2.4.3). These components are necessary to strengthen and put into practice the Government policies on renewable energy. The activities of the PDF B (see 3.5) address that need and also aim at establishing the incremental cost of the project. The PDF grant is aimed at assisting preparation of the GEF-supported renewable energy component that will be part of the larger mini-grid replacement operation.

#### **3.4 Execution**

For the GEF, UNIDO is the executing agency with expanded opportunities, whereas the national counterpart agency is the Centre for Management of Priority Programmes and Projects (GEPROP) of the Science and Technology Agency under the Ministry of Science, Technology and Environment. A local Programme Management Unit (PMU) will be set-up and staffed at GEPROP.

A Project Steering Committee (PSC) will be set up to advise UNIDO and GEPROP on the direction of project development and implementation.

### 3.5 Description of proposed PDF activities and outputs

The proposed activities are discussed at greater length in the following passages. The goals of industrial and business development in a sustainable manner, both through the creation of new enterprises and the enhancement of existing companies must be a central concern in any activity implemented by UNIDO. Therefore it is intended that the barrier removal activities and exercises designed at this stage in the programme will lead to the creation of viable and sustainable business plans after the main implementation phase. Furthermore any planned fuel substitution initiatives for the island's industrial sectors will be strongly intended to increase their relative profitability, as well as the environmental sustainability of their operation.

Two levels of activities are generally required for the development and dissemination of a 'new technology', process and/or approach. Firstly activities mainly at a controllable level, thereby addressing the type of barriers as indicated before, but on a limited scale only; i.e. a pilot programme in a restricted target area. Secondly, activities that put in place the conditions required for the replication of a pilot programme. Often the latter activities are nation-wide and build on the outcome of the pilot project. The proposed initiative will focus on the design of a successful pilot programme as well as putting in place the conditions for the replication of the pilot programme beyond the target area of the Isla de la Juventud.

#### 3.5.1 Pilot level activities

GEF project will not be able to carry out detailed, full national renewable energy supply assessments nor demand assessments for modern energy services. Nevertheless the approaches developed under the pilot level activities can form a solid basis for national assessments. Therefore, in addition to the specifics of the activities described below it is important that the processes, approaches that are being designed for implementation during the full-scale project are well documented so they can serve as a basis for the replication activities.

##### *Activity 1: Renewable energy supply assessment*

The assessment will build on the outcomes of earlier work done in this area and will start with the collection of relevant secondary renewable energy supply data for the Isla de la Juventud. Data gaps will be identified and appropriate data collection and analyses methods will be selected to collect and analyze missing and necessary data. The focus of the data collection should be on ensuring that sufficient data is available for the proper selection and design of the pilot projects. It will not be necessary to complete the renewable energy supply balance for the Isla de la Juventud.

Results from the UNIDO funded pre-feasibility study for the Isla de la Juventud show that the main renewable energy sources potentially available at the Island are the following:

- Solid woody biomass from forests and forest products;
- Biogas as a result of intensive pig farming (pig manure);
- Biodiesel to be produced from vegetable oil;
- Landfill gas from organic urban waste;
- Solar for water heating;
- Wind for electricity generation; and
- Mini hydro power (20-30 kW systems). Since this renewable energy source is already fully incorporated in the GEF funded medium size project entitled "*Cuba, Small Hydro Development,*" it will not be addressed in this initiative. However, organizations involved in the implementation of the



this initiative will be supplied with available hydro data for Isla de la Juventud, so they can assess the possibility to include it in their project activities.

Although in principle all these renewable energy resources will be addressed under this activity, it is expected that the biomass related renewable energy resources will be bundled and form the core of the full-scale activities. If supply data suggests that further wind energy development or solar water heater development warrants increased attention, international bilateral donors interested in these specific activities will be addressed as appropriate; e.g. Denmark when it concerns wind energy development and the French for solar water heating.

### ***Activity 2: Demand assessment for modern energy services***

The assessment will build on the outcomes of earlier work done in this area and will start with the collection of relevant secondary renewable energy supply data for the Isla de la Juventud. Data gaps will be identified and appropriate data collection and analyses methods will be selected to collect and analyze missing and necessary data. The focus of the data collection should be on ensuring that sufficient data is available for the proper selection and design of the pilot projects. It will not be necessary to complete the demand balance for the Isla de la Juventud. Results from the UNIDO funded pre-feasibility study for the Isla de la Juventud show that the main demands for modern energy services relate to:

- a) electricity generation;
- b) provision of transport fuel, and
- c) heat requirements for industrial and domestic sectors.

Main focus will be on electricity generation as this is currently the major problem area as it concerns reliability, high costs and full dependence on (international) imports.

### ***Activity 3: Renewable energy technology assessment***

A range of internationally available renewable energy technologies exists that can be applied to convert biomass, solar and/or wind energy resources into useful, required modern energy services at the Isla de la Juventud and the mainland of Cuba. An assessment will be made, making use of technical and cost data available through secondary sources such as project documentation, supplier information, consultant knowledge and experience, internet, etc. Based on this a selection will be made and the specifications of technology packages will be prepared for the pilot projects to facilitate procurement during the full-scale project. This will be complemented with a shortlist of a minimum of 5 equipment suppliers.

### ***Activity 4: Feasibility studies***

A maximum of 4 detailed feasibility studies will be carried out to develop pilot projects at the Isla de la Juventud to be implemented under the full-scale programme. Technical, cost-benefit, institutional and environmental issues need to be detailed to the extent possible and the feasibility study needs to include a detailed financing plan for the pilot project. Important criteria to be used for the selection of the pilot projects include:

- a) resource availability;
- b) demand for modern energy services;
- c) technology availability and accessibility;
- d) cost-effectiveness;
- e) willingness of the local stakeholders to participate in the pilot project;
- f) availability of financing, and
- g) replication potential.



Feasibility studies will include the design of financial mechanisms and business models. With this regard, full use of UNIDO's experience in the operation and maintenance of rural energy systems will be made.

### **3.5.2 Replication level activities**

#### ***Activity 5: Assessment of the replication potential***

One of the criteria to be used for the selection of the pilot projects is the replication potential of similar type of projects at the mainland of Cuba. Therefore it is necessary that a rapid assessment is made of this replication potential. Elements to be considered in this assessment are:

- a) resource availability;
- b) cost-effectiveness;
- c) willingness of stakeholders to participate and
- d) the availability of financing.

This activity is NOT a detailed national assessment on the replication potential, but merely an exercise to be carried out to properly select pilot projects and moreover to justify (the level of) GEF funding for the full-scale phase.

#### ***Activity 6: Review of policy and regulatory frameworks***

Under this activity, the policies, legislation and regulations will be assessed to identify policy barriers to the development of renewable energy systems and policy changes that would facilitate accelerated development. The assessment will include at minimum the consideration of:

- a) energy pricing, tariffs;
- b) electric utility regulation;
- c) tax/financial incentives and disincentives for renewable and conventional energy;
- d) public sector procurement guidelines;
- e) design and installation norms and standards and
- f) equipment standards, codes and regulations.

Furthermore, a project component to support the introduction of these changes by the Government of Cuba will be designed.

### **3.5.3 General activities**

#### ***Activity 7: Incremental cost calculations***

The incremental cost calculations for the project will be made based on the economic analysis of the with or without project situation. The outcome will include the cost of a ton of carbon, and justify the non-barrier removal grant portion of the GEF.

#### ***Activity 8: Support for the Counterpart and renewable energy development workshops***

Seed support will be given to the Counterpart to establish the Project Management Unit (PMU) to guarantee an effective operation at the time of effectiveness of the lending operation.

For the above-mentioned activities, the actors involved need to be identified as well as their respective roles. In this regard it is important to organize national workshop(s) to discuss issues related to the preparation of the full-size project in the initial phase of the implementation of the PDF B activities to



inform national stakeholders. Likewise, at the end of the PDF B activities to present the outcomes and receive feedback to be incorporated to reflect national interest and concerns. It is anticipated that representatives of national financial institutions, international investors, donor community, international NGOs, suppliers, vendors, end-users and government are present at such a workshop. Besides, there needs to be sufficient technical representation to ensure that technical issues related to renewable energy based provision of modern energy services as well as the technical risks are properly highlighted.

#### ***Activity 9: Preparation of the full-scale project brief***

A project brief that includes all the required GEF criteria, notably the incremental cost matrix, the logical framework, CO<sub>2</sub> calculations and a methodology for monitoring and evaluating the full-size GEF intervention will be prepared. In addition to the preparation of the project brief, the co-financing arrangements for the full-size programme will have to be detailed and secured to the extent possible.

### **3.6 Monitoring and evaluation**

PDF Block B activities will be completed within 12 months from the start which is estimated to take place in the last quarter of 2001. The implementation of the project will be monitored by the UNIDO Headquarter staff (Industrial Energy and Climate Change Branch) as well as by the UNIDO Field Representative in Cuba. Standard evaluation of the project will be carried out according to the well-established UNIDO Evaluation Procedures. Additional evaluation can be performed as and when required by the GEF and according to GEF guidelines.

### **3.7 National Level support**

The Government of Cuba is committed to the development of renewable energy as shown by signing/ratification of the UNFCCC and the Kyoto Protocol, the published energy policies and plans. Further, the present project fits well into the rural development schemes supported by the Government. The Government has also passed legislation to promote foreign investors and joint venture companies wishing to invest in Cuba.

### **3.8 Summary of project preparation work outputs**

The main outputs of the planned PDF B activity summarized as follows:

- A GEF project brief for a full-size project, that addresses the activities required for assisting the reduction/removal of identified barriers for increased use of renewable energy based provision of modern energy services;
- A financing plan has been developed as an integral part of the project brief and co-funding for the full-scale project has been committed to the extent possible;
- The foundation has been laid for the realization of a selected number of pilot projects at the Isla de la Juventud as well as the activities identified for replication of these pilots at the mainland of Cuba;
- Indicators and a methodology for monitoring and evaluation of the GEF intervention during the implementation of the full-size project;
- An agreed upon institutional set-up and implementation arrangements of the full-size project as well as a preliminary draft work plan, including time and activity schedule;
- Workshops to initiate, review and revise the (draft) project brief preparation process; and
- A pool of national, regional and international consultants has been identified for implementing the full-size project.



### 3.9 Costs

The total budget for this PDF Block B is US\$ 455,000 with a GEF contribution in the amount of US\$ 325,000. Co-funding in the amount of US\$ 50,000 will come from UNIDO. Furthermore, an in-kind contribution in the amount of US\$ 80,000 from the national counterpart agency (GEPROP) and other Cuban institutions as appropriate.

PDF Block B activities	Cash contribution UNIDO	GEF	In-kind contribution Gov. of Cuba	TOTAL
Assessment of renewable energy supply and demand for energy services	15,000	10,000	10,000	35,000
Renewable energy technology assessment	15,000	10,000	5,000	30,000
Feasibility studies of pilot installations	10,000	70,000	5,000	85,000
Design of financial mechanisms and business models	5,000	30,000	5,000	40,000
Assessment of the replication potential	5,000	40,000	10,000	55,000
Policy and regulatory framework		15,000	10,000	25,000
Incremental cost calculations		30,000	5,000	35,000
Counterpart support, workshops, awareness, documentation		70,000	25,000	95,000
Preparation full-scale project		50,000	5,000	55,000
<b>TOTAL</b>	<b>50,000</b>	<b>325,000</b>	<b>80,000</b>	<b>455,000</b>

### 3.10 Timing

It is anticipated that PDF Block B activities will commence in the fourth-quarter of 2001 and will be completed within 12 months.

### 3.11 Other donor involvement

Cuba attracts considerable donor interest. The place of energy in general and rural energy in particular is moving upwards in the priority lists of major bilateral donors. Furthermore, multilateral funds and lending agencies such as UNFID, IFAD, etc. are increasing their activities in the energy sector. In the present case, strong donor interest has been observed during the initial contacts.