

**UNITED NATIONS DEVELOPMENT PROGRAMME
GLOBAL ENVIRONMENT FACILITY
PROJECT BRIEF FOR PDF FUNDING (BLOCK B)**

Country:	Pakistan
Project Title:	Commercialization of Wind Power Production in Pakistan
Focal Area:	Climate Change
Amount of PDF Funding Requested:	US\$ 350,000
Government Cofunding:	UNDP TRAC and others to be determined during PDF Block B
Duration:	14 months
Requesting Agency:	UNDP/Government of Pakistan
Executing Agency:	UNOPS
Block:	PDF Block B
Block A Grant Awarded:	Yes

I. Summary Project Objectives and Description

Major power generation capacity additions have recently been achieved in Pakistan as a result of policy initiatives taken in response to widespread power shortages in the Eighties. These additions are based mainly on residual fuel oil and natural gas as fuel, resulting in a marked shift in favor of thermal generation and away from the traditionally dominant hydel sources. In recent decades, the supply of electricity to less developed areas has also been accorded high priority in Pakistan, although economic considerations in grid expansion have largely limited an otherwise aggressive rural electrification program to areas easily accessible from the national grid. These factors, coupled with relatively high system losses, have contributed to an unprecedented increase in emissions of greenhouse gases (GHGs) from the power generation industry in the country.

The focus of planners in Pakistan, for the short term, is now shifting to options that lower demand for fossil fuels and result in better transmission and distribution efficiencies. For the longer term, the emphasis is expected to be on exploiting the remaining hydel potential, adopting high-efficiency combined cycle technologies, and harnessing renewable energy resources.

An option which merits serious consideration in Pakistan is wind power. Wind power provides an opportunity to reduce dependence on imported fossil fuels and, at the same time, expand the power supply capacity to remote locations where grid expansion is not practical while reducing GHG emissions. Preliminary analysis of wind data in selected coastal locations in the Baluchistan province indicates that a potential exists for harvesting wind energy using currently available technologies in the West. This project brief aims to obtain

PDF Block B funding for examining the feasibility of setting up a 10 to 15 MW wind generation project near the harbor town of Pasni in Baluchistan to demonstrate the sustainable economic and environmental benefits of wind turbines for power generation which could be replicated elsewhere along the coast. The current generation capacity at Pasni, of about 15MW, is based on diesel generation and demand growth is projected at 11% per annum, spurred mainly by the local fishing industry. At the prevailing international price of US\$ 1,200/kW, capital investment for a 15 MW wind power project is estimated at US\$ 18 million. The PDFB process will explore the possibility of setting up a wind farm to be integrated with existing diesel power generation at the site, and a joint venture of an experienced foreign company and a local investors to ensure efficient project design and operation. The project if setup at the above capacity will directly reduce consumption of diesel fuel at the existing power plant by up to 13,205 tons/year and decrease associated CO₂ emissions by at least 42,522 tons/year. There will be additional savings due to a reduction in the cost of transporting diesel fuel to the power plant from Karachi, over 300 km away.

The project will be implemented in two phases:

1. The initial PDF Block B Grant will be utilized for conducting a detailed investigation of wind resources, site selection, project design, implementation agreements, and environmental impacts as described in sections III and IV;
2. Subject to favorable findings of the PDF Block B Project, funding will be sought from GEF, other multilateral and bilateral sources, private investors, and the GoP for developing the full project at the identified site.

Project Objectives

- a) The overall objective of the project is to facilitate a low CO₂ path for development through establishing and demonstrating commercial viability of a package for widespread harnessing wind energy in remote areas of Pakistan. This will be done through
 - (i) identifying key barriers and a package to overcome significant barriers to future investment in this resource and
 - (ii) scaling up the practical operations and demonstrations package of the technology to a critical mass to attract potential entrepreneurs. The success of the project therefore has significant effect on the future of alternate technology projects in the country. If the project can be replicated in other suitable locations, the approach becomes a “win-win” activity when both manufacturing and marketing costs come down. The process it can have an appreciable impact on electricity supply patterns in the country.
- b) To reduce the use of fossil fuels for power generation in Pakistan, consequently affecting direct reductions in greenhouse gas emissions, and reducing the financial burden on the national economy of importing, processing, and transporting fuel shipments.
- c) To promote the use of low cost technologies. This is particularly important given the financial constraints currently faced by public utilities and power producers in both the public and private sectors in Pakistan.
- d) To introduce the concept of using basic technology, thus cutting operations and maintenance costs. The training of personnel would also be simpler and more cost-effective.

- e) To facilitate a transfer of technology and skills by involvement of local personnel in the design, installation and operation of the wind farm and through special training programs.
- f) To contribute towards the socioeconomic development of one of the most underdeveloped regions in the country, facilitating national plan objectives of rural electrification and thereby improving living standards, health care, and economic opportunities for the local communities.

Project Description

The coastal areas of Pakistan are particularly well-suited to the construction of wind power generating systems. It is proposed that a wind generating system of 10 to 15 MW capacity be installed at a site near Pasni or other such suitable location. The PDF Block B Project Document will carefully examine the commercial feasibility of establishing such a wind farm and identify the investment, technical aspects, and material and manpower resources as well as operational arrangements for constructing and operating such a farm.

On the basis of site visits and preliminary data analysis the proposed project could be located near the town of Pasni in the province of Baluchistan, along the southern coast of the country (see **Exhibit 1**). Pasni is a harbor town with a population of about 50,000. The local economy is dependent primarily on fishing and remittances from labor exports to the nearby Gulf countries, and town development schemes feature the expansion of harbor facilities as a primary objective. Pasni is located about 300 km from the national power grid and from the nearest large city of Karachi, but road conditions make access to the area arduous and expensive. At present, there is an installed diesel generation capacity at Pasni of 17 MW with plans for an additional 27 MW. The powerhouse and associated facilities are manned by over 100 utility employees, with additional crews for the 600,000 lts storage of diesel fuel nearby. The government also proposes to install diesel combustion turbines of 10 MW capacity at Ormara to the east of Pasni. Diesel will have to be transported to Pasni and Ormara from Karachi.

The PDF phase will examine the feasibility of locating the demonstration wind farm such that will be integrated with the existing diesel power generators in an arrangement that enables the diesel generators to be used as backup supply when wind power generation is low. The level of power output expected is 11 kV, which is equivalent to the generating voltage of the existing diesel system. The existing grid station will be used to dispatch power to the area grid for distribution in surrounding communities.

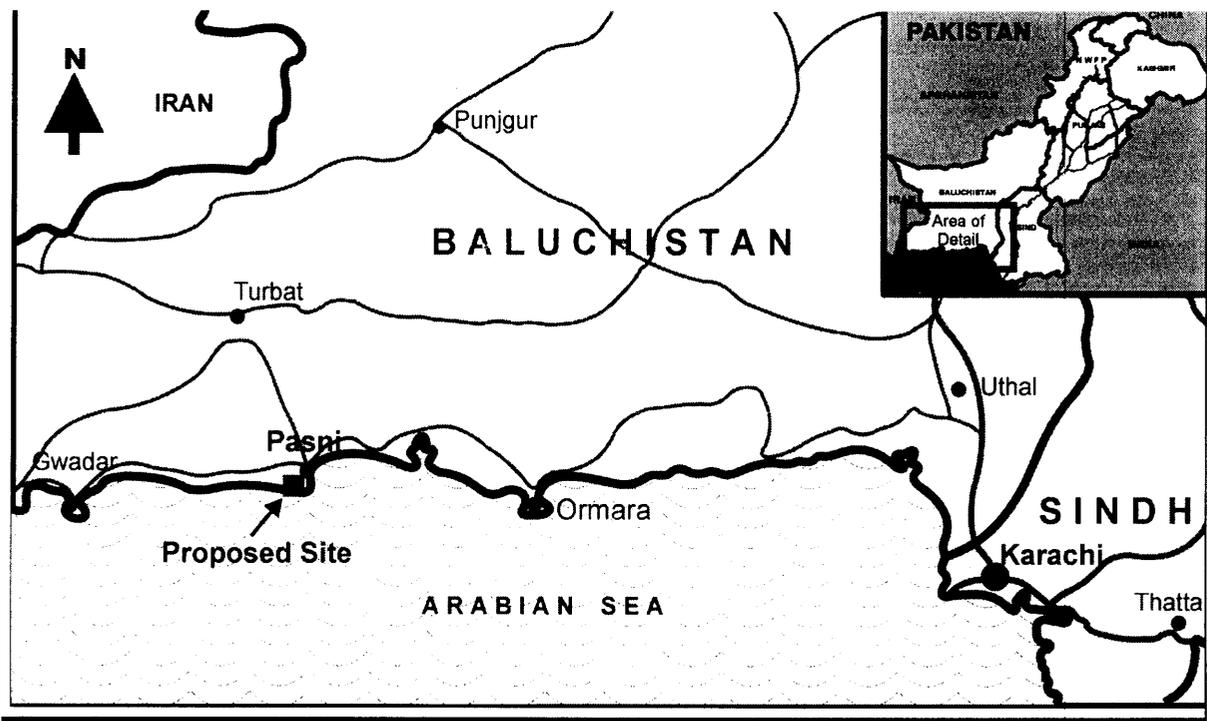
The most significant environmental impact of the project will follow from the reduction in the consumption of diesel fuel at the Pasni and/or Ormara plants. It is estimated that the project could lead to savings in diesel fuel of up to 13,205 tons per year, which would cause a reduction of 39,676 tons per year in associated carbon dioxide emission levels. Reduced use of diesel generators will also lead to an improvement in air quality by lowering emissions of particulate matter. Additional savings will accrue from cost savings related to the transportation of diesel fuel from Karachi by road.

Other benefits of the project are summarized below:

- a) Electricity makes possible the use of mechanized systems for providing drinking water. This reduces the workload of rural women and enables households to access groundwater reserves which are less likely to be contaminated.
- b) Electricity is considered essential for the establishment of health centers. Immunization facilities can only be extended by health centers located in areas where the supply of electricity is regular. The resulting effects on health indicators are thus likely to be positive.
- c) The regular supply of electricity can have a significant impact on the development of harbor facilities, such as cold storages, processing and packaging equipment, etc.
- d) The project will build institutional and technical capacity in Pakistan in alternative energy systems.

If the project proves to be successful, it will be replicated in other areas which cannot easily be connected to the national grid. The long term benefits of this are obvious

Exhibit 1: Location of potential wind power project site near Pasni



II. Preparatory Work and National Level Support

In 1992, a National Conservation Strategy (NCS) was prepared which emphasized the role of renewables and energy efficiency in sustaining Pakistan's energy future. Consequently, the 8th Five Year Development Plan (1993-1998) adopted the NCS recommendations and identified the development of renewables as one of the fourteen core areas for implementation. However, the sector still awaits a comprehensive policy thrust.

The emerging mitigation strategy of GEF/UNDP Asia Least-Cost Greenhouse Gas Abatement Strategy (ALGAS) for Pakistan has clearly identified the use of renewables such as solar thermal and wind energy systems as potentially cost-effective greenhouse gas mitigation projects and, in this connection, proposed the need to analyze and develop renewable energy resources and to implement policies, measures, and incentives for promoting private sector investment in renewables as a priority activity.

The Government of Pakistan has enunciated several policies and strategies aimed at poverty alleviation, social development, and rural electrification. Many of the benefits of the proposed wind power project, as outlined above, directly contribute to meeting these strategic objectives by providing a ready source of power in remote locations, leading to promotion of local industry, employment, and income levels as well as indirectly by improving the quality of basic social services in the area which are dependent on a steady supply of electricity, such as health facilities.

There is a strong consensus in Pakistan about increasing reliance on renewable energy use especially wind energy where ever feasible in order to meet the increasing energy demand in a sustainable and environmentally benign manner. The Ministry of Environment, Local Government and Rural Development; Ministry of Petroleum and Natural Resources; Ministry of Water and Power; Ministry of Science and Technology; and the Energy Wing of the Planning and Development Division support an effort to bring in new and renewable energy use

The current government policy on private power generation, coming on the heels of massive foreign investments in expensive and polluting fossil fuel-based thermal plants, is increasingly looking towards options that can reduce dependence on imported oil products, so that the extreme strain placed on the national infrastructure, such as ports, pipelines, road and rail transportation, handling and storage facilities, can be alleviated and the adverse national foreign exchange reserve situation can be provided necessary relief. Furthermore, the GoP is also reducing public sector involvement in power generation and actively encouraging private capital inputs into all forms of electricity production, with numerous incentives for potential investors. The state owned power utility, WAPDA, has shown a keen interest in replacing some of its expensive diesel generation in remote and difficult areas such as the Baluchistan coast with wind and solar power stations and has offered assistance in project development, commissioning, and connection to the local grid.

Finally, the GoP has identified the need for increased generation capacity at Pasni, Ormara, and Gwadar, based on local domestic and industrial demand as well as the anticipated requirements of new ports and harbors currently under construction at these sites. The GoP has prepared feasibility documents (PC-1) for the erection of 27 MW and 10 MW additional diesel capacity at Pasni and Ormara, respectively. Currently, these plans have been stalled due to financial constraints in the public sector, and will be offered for private sector investment instead. The proposed wind project would offset some of this planned diesel capacity, and would therefore reduce the need for additional thermal generation. It is believed that for this reason alone the project has strong government and WAPDA support.

As part of PDF Block A activity culminating in the production of this project brief, intensive consultations were held with various relevant government agencies and ministries, in which ready support to the development of wind energy in Pakistan was assured.

III. Description of Proposed PDF Activities

The project falls directly within Operational Programme 6 of the GEF Climate Change Operational Strategy-Promoting the adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs.

Establishment of Baseline Scenario

The PDF will evaluate the overall energy and power supply and demand situation in Pakistan with particular emphasis on factors that might contribute to or inhibit the development of wind resources. These include energy supply shortfalls, demand growth, infrastructure constraints, delivered costs, fuel availability, and financial or economic costs. In remote areas where major supply gaps exist and potential for wind energy resources exist. They will be placed in the context of overall national development priorities.

Review other issues directly relevant to the power industry, such as regional development plans; planned power generation and transmission investments; grid expansion; rural electrification; privatization of generation, transmission, and distribution; fuel supply options and costs; population growth; environmental considerations; and economic and infrastructure development will also be reviewed with particular reference to potential wind energy project sites along the Mekran coast in Baluchistan.

Review the recent experience with independent power producers and private power regulations in Pakistan and its suitability to renewable sources, in view of the intensive restructuring of the national energy sector currently underway in Pakistan for the energy sector.

Identify and evaluate the existing barriers to wind energy use and its commercial acceptance and also marketing of the energy source at remote areas of coastal Baluchistan.

This will involve a close look at existing barriers—financial, technical, institutional, informational, policy—that have inhibited investments in the past in the renewable energy sector in general and wind energy in particular. The focus of the project formulation would be to identify and, to the extent possible, recommend changes aimed at removing such barriers in the process of developing, implementing, and operating the demonstration project. Specifically, the **main barriers to be addressed** are as follows:

Lack of Wind Data: Detailed knowledge of the wind resource is crucial for determination of the expected energy capture of a wind energy project.¹ The existing wind data routinely collected by the Pakistan Meteorological Department does not provide the level of quality and detail required for a proper wind farm design, as it is not available for many prospective locations, is monitored at insufficient height above ground, may suffer from nearby obstacles, or may otherwise be inadequate for a proper evaluation of the available wind conditions. A proper wind resource assessment, which provides sufficient information to evaluate statistical wind speed distributions at actual site locations, is therefore required to be undertaken as the first step in evaluating wind energy potential in Pakistan.

¹ An annual mean wind speed interval at hub height (approx. 30 to 50 m) going from 6.0 m/s to 7.0 m/s corresponds to a change in capacity factor of from approximately 20% to 28%, or an increase of 40%, for a typical wind turbine. If long-term measurements at hub height at the site are not available, the uncertainty in the assumed data could easily be as high due to both the temporal and spatial variability of the wind.

Low Confidence in Technology and Ignorance in Application Potential: Although now a well-established commercial technology in developed countries, wind turbines are a fairly recent technology which is largely unfamiliar to developing countries. As such, there still persist common misperceptions about its applicability, cost, and reliability in comparison with conventional sources of power generation. Since the development cycle of wind farms has been fairly short (mainly the decade of the 1980s), there is still a reluctance to accept it as a viable and tested technology by both policy-makers and investors. However, in countries where wind power has been introduced (the US, Canada, West Europe, China, and India), its growth has been very rapid, with 20,000 turbines currently in operation and 40,000 MW of worldwide installed capacity targets by the year 2010. The PDF process will identify and develop initial plans for providing support to the dissemination of information and skill through training and technical assistance

Policy and Operational Issues: In countries where wind power has not yet been harnessed, important shortcomings exist in the applicable policy framework that must be redressed before such projects can be established. For instance, the variability of wind power output requires power purchase agreements and tariff calculations that take the daily and seasonal availability of the wind resource explicitly into account so that the investor can be assured of a reasonable and practical financial playback. Furthermore, the operational arrangements in connecting wind power to a distribution grid, including load dispatch and balancing, backup supply, switching controls, and power quality must also be resolved at the outset to the satisfaction of both the producer and purchaser of wind-generated electricity, and experience in formulating such agreements may not be locally available. Therefore, before wind energy can be commercially introduced, such policy and institutional issues must be resolved and clearly defined, through the PDF, by drawing upon the practice in other countries where such arrangements have already been working successfully.

Local Experience and Technical Capabilities: The unfamiliarity of wind power technology presents another perceived barrier to its ready acceptance because the local capability in manufacturing, operating, and maintaining such systems has not been ascertained. Investors are usually shy of relying on totally imported equipment for fear of long down-times and costly servicing and spares sourced from foreign suppliers. However, even a cursory assessment would indicate that a significant industrial engineering, manufacturing, and servicing capability exists in both the public and private sectors in Pakistan that could be utilized for wind power projects, thereby reducing the costs for constructing and operating such plants and ensuring successful further transfers of technology to the country. The PDF process will enquire into the equipment procurement/production opportunities through private investors and joint ventures.

Issues Specific to Wind Energy: Some issues specific to wind energy usually cause concern for first-time users. Even if these issues do not need to be a technical problem, they can still be barriers as long as potential investors, policy makers, utilities, operators or the public perceive them as problems.

A usual criticism of wind power is its unreliability, that is the unpredictability of the wind available at any given time which translates into an uncertainty in the evaluation of power dispatch from the turbines. The variable wind power output is argued to be worth less than, for instance, power from an equivalent thermal plant that has a higher probability of being

able to operate at its rated power at peak demand. Even if some capacity credit can be shown statistically for geographically dispersed systems, this concern could be an issue for systems with a very high penetration of wind energy in overall power system capacity. However, studies from various countries have shown that up to 10% of the energy can be produced by wind turbines without introducing significant variability issues and associated additional costs.

Wind energy resources are often commercially viable at remote locations such as coastlines and mountainous regions. Access, construction, and operation of wind turbines therefore often implies additional challenges which act as a deterrent to potential investment. Such barriers can often be overcome with the active participation of government agencies that can provide the necessary logistical and infrastructure requirements for facilitating the development of wind farms in otherwise difficult locations.

IV. Outputs from the PDF B fund activities:

The PDF B funded activities will include the following specific tasks:

- National baseline conditions pertaining to power supply and demand and future strategies would be established, with emphasis on their impact on the development of wind energy projects;
- Existing policy, financial, technological, and other barriers inhibiting commercial interest in wind farms will be identified from a project development perspective;
- A dedicated wind data monitoring exercise would be undertaken to evaluate the technical, siting, and capacity parameters of the proposed wind farm located on the Baluchistan coast;
- Load demand in the region containing the potential sites would be assessed based on past utility data and future area infrastructure, generation and transmission investment plans;
- Based on the preceding analyses, a potential primary and backup site would be selected for locating the wind farm;
- A technical evaluation will be conducted to determine the generation capacity and grid inter-tie, based on wind availability, diesel fuel savings, load demand, and additional relevant considerations;
- A financial and economic analysis will be carried out to define project costs, tariffs, returns on investment, and economic benefits accruing from the wind farm;
- Plant specifications and equipment vendors and suppliers will be identified to the extent necessary at the feasibility stage;
- Proper implementation arrangements are critical to project success. These would be examined critically during the PDF phase to identify all the key partners and determine the respective roles of the government, funding agencies, power utility, and private investors and operators.

- In addition, operational arrangements to ensure integration of the farm with the existing diesel generation and distribution system would be defined during the PDF process. This activity would also lead to policy recommendations to address the specific needs of future investments in wind energy in Pakistan;
- Land acquisition needs for the project would be determined;
- An environmental impact assessment (EIA) would be conducted to determine potentially adverse project impacts on the natural and social environment at the site;
- Measures for affecting transfer of wind energy technology to Pakistan would be identified and incorporated into project activities to the extent feasible. These would include, for instance, local manufacture of components and training in wind data assessment and plant operations;
- Incremental Cost analysis: This activity will estimate incremental cost in a manner consistent with the guidelines of GEF;
- This phase will identify exerts, regional and national institutions through workshops and training and be targeted for the dissemination of project results to build up local capacity and support to the long run sustainability of the project; and
- A full project brief would be prepared containing the elements described above to be used as a base for soliciting funds to meet baseline and incremental cost of project financing and development.

V. Justification for PDF B Grant.

The GEF-Pakistan programming workshop (1996), organized jointly by the Ministry of Environment, UNDP, World Bank and UNEP, analyzed and synthesized project concepts that are eligible for probable GEF funding under the focal area of Climate Change. The exercise showed the need for identifying new and renewable sources of energy and methods of addressing the market penetration barriers that are faced in the process of developing them as commercially viable sources of energy.

Within the context of the current energy sector scenario in Pakistan and alternate sources of renewable energy, preliminary analysis indicates wind energy development to be an initiative with considerable potential to benefit from a GEF initiative. This source of energy is not only supportive of national development goals of providing energy to off-grid sites, it is also consistent with internationally agreed programs of actions for sustainable development.

In accordance with the GEF Operational Program 6 on Climate Change the PDF B request is designed to address the objective of promoting wind energy in Pakistan. To this end, the PDF B exercise is needed to identify the bottlenecks that are currently faced by policy proponents of renewable energy in the economy, with particular reference to existing as well as prospective energy sector plans. It is required to identify and define the scope of activities and the steps to be undertaken to ensure effective implementation of a full-scale GEF project that will address technical, information, implementation and institutional barriers to wind energy commercialization in Pakistan through the development of an actual demonstration project. As per the requirements of a Barrier Removal project under Operational Program 6,

the PDF assistance will set the ground for wider application of the technology on a commercial scale. The project will set in place a complete package of resource assessment, resource development, evaluation of economic viability marketability, and effective implementation arrangements for potential demonstration sites. The project, upon completion, would have demonstrated and established a working modality considered necessary for economic replication and increased private sector investments in the sector

VI. Eligibility

Pakistan ratified the UN Framework Convention on Climate Change on June 1, 1994. In line with the reporting requirements of the Convention, Pakistan is now undertaking a comprehensive inventory of greenhouse gas (GHG) emission sources and sinks and preparing prioritized mitigation options and project portfolios under the GEF-funded Asian Least Cost Greenhouse Gas Abatement Strategy Project (ALGAS). Among the GHG mitigation measures being considered under ALGAS is the increased use of renewable energy sources. To this end, the setting up of a commercially viable wind energy project will be instrumental in realizing the accelerated exploitation of this clean technology in the future.

The "Commercialization of Wind Power Production in Pakistan" project is in harmony with the GEF Climate Change objective to promote activities that would stabilize GHG concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the global climate system. The project will directly contribute to quantifiable GHG emissions reduction while also paving the way for future, larger scale replication resulting in even greater mitigation. It satisfies all the project selection criteria and coincides fully with the priorities set out in the GEF Operational Strategy.

In accordance with the GEF Operational Strategy on Climate Change, this project brief is designed under Operational Programme 6 to "Promote the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs."

VII. Time Table

The activities under the PDF Block B Grant are expected to commence in December, 1997 and will be completed within fourteen months by March, 1999. The Project Document for the "Commercialization of Wind Power Production in Pakistan" will be submitted to the GEF Secretariat in time to be considered by the November 1997 meeting of the GEF Council. The implementation of the full project could commence soon after its approval.

The full project is expected to become operational approximately two years after initiation. The timing of the project implementation is important because:

- a) The GoP is currently preparing the 9th Five Year Development Plan (1998-2003) and the project could contribute meaningfully to national planning, especially for renewable energy use, in line with national development priorities.
- b) The private power policy of 1994 is also under extensive review and a new policy is expected to be approved by the end of 1997. Therefore the proposed PDF Block B activities could greatly help in identifying policy and institutional barriers to commercial investments

in wind energy in Pakistan and assist the GoP in removing such barriers and promoting private sector interest in developing the wind energy resource through new policy incentives.

c) The ALGAS project will come to fruition by the last quarter of 1997 and the wind energy project, drawn from its mitigation options analysis, would help sustain the momentum of GHG mitigation activities in Pakistan and encourage the adoption of additional ALGAS recommendations as well.

VII. Items to be Financed

The PDF Block B Grant of US\$ 350,000 will enable the activities set out in **Section IV** above to be carried out, as described in Exhibit 2. GEF assistance will provide for project personnel (consultants, subcontractors, engineering and field staff, secretarial and logistical support, etc.), project steering committee meetings, broad-based consultations at all levels, and the writing of all project reports as well as the GEF Project Document.

Exhibit 2: Proposed budget for PDF Block B Activities

<i>Category</i>	<i>Cost (US\$)</i>
Local Experts	120,000
International Experts	70,000
Domestic Travel	5,000
International Travel	10,000
Training	20,000
Wind Monitoring	95,000
Project Document Preparation	20,000
Project Support Services	10,000
Total PDF B Request	350,000
Govt. Contribution in Kind	30,000



ENERCON

National Energy Conservation Centre

GOVERNMENT OF PAKISTAN
MINISTRY OF ENVIRONMENT, LOCAL GOVERNMENT
AND RURAL DEVELOPMENT

ENERCON Building, G-5/2 Islamabad, Pakistan
Tel: (051) 9206005, 9209023-5 Fax: (051) 9206003
E-Mail: root@enercon.sdnpc.undp.org



Enc/Elg&rd/db-pp/gef-FP/97

September 02, 1997

Subject: PAK/97/G41 Commercialization of Renewable Energy Sources - GEF Wind Power Project

This is with reference to our earlier communication with UNDP on the above subject.

This is to convey that the Ministry of Environment, Local Government, and Rural Development, accords high priority to the development of wind energy as a source of new and non-conventional sources of energy to meet the growing demand in the remote areas of Pakistan. As such in our capacity as the focal point for GEF in Pakistan, we endorse UNDP's pursuits for GEF funding to further the development of commercial wind energy potential for Pakistan.

With best regards and hoping to have continuing cooperation on the subject.

(K. M. Zubair)
Chief, ENERCON/Focal Point

Mr. J.K. Robert England
UNDP Resident Representative
Pakistan.

UNDP/ISLAMABAD					
FILE NO.	RR	D+R (P)	DRP (C)	UCD	UNIT
ACTN					1
INFO					
INTLS					
DATE STAMP				- 5 SEP 1997	

ENERGY EFFICIENCY IS OUR BUSINESS