UNITED NATIO\NS DEVELOPMENT PROGRAMME

Project of the Government of

The People's Republic of China

PROJECT DOCUMENT

Project Budget Number: **CPR/97/G31**

Project Title: **Capacity Building for the Rapid Commercialization of Renewable Energy**

Duration: 5 Years

Estimated Start Date: **December 1998**

Estimated End Date: **December 2003**

Executing Agency: **UNDESA**

Government Implement Agency: **SETC**

Project Site: **Beijing, and Provinces**

UNDP and Co Financing	
UNDP/GEF	$8,800,000
Bilateral Donors	
Australia	$3,000,000
Holland	$2,530,000
Gov't Co-financing	$11,500,000
TOTAL	**$25,830,000**
UNDP Associated financing:	$742,500
Donor Parallel financing:	$500,000

Classification Information:

CC sector and sub-sector: Energy and Environment **Primary type of intervention:** Capacity Building, Pilot Projects

DCAS sector & sub-sector: **Renewable energy** **Secondary type of Intervention:** Direct Training

Primary areas of focus/sub-focus:

Brief Description

The project will promote the widespread adoption of renewable energy technologies (RETs) in China by removing a range of barriers to increased market penetration of the technologies. It will strengthen the capacity of China to shift from supply-oriented technology deployment to demand-driven, investor- and consumer-friendly approaches. The project will develop market-based institutions and instruments to attract new players in the renewable energy industry and increase investments inRETs. To provide first-hand knowledge of a particular instrument/institution and demonstrate its validity to increase market penetration of RETs, the project will support pilot activities for five promising technologies, namely: (i) rural electrification by solar and wind hybrids; (ii) wind farm development; (iii)biogas production; (iv)bagasse cogeneration; and (v) solar-water heaters. The selection of technologies was made on the basis of recent assessments of market conditions and potential for future GHG reductions. The project has been carefully designed to support and complement ongoing and planned projects of UNDP, the World Bank and bilateral aid agencies.

On behalf of	Signature	Date	Name/Title
The Government:	_____	_____	_____
UNDP:	_____	_____	_____
UNDESA:	_____	_____	_____

UN official exchange rate at date of signature: $1.00 = RMB Y8.266

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A.- CONTEXT

1 Description of the Sub-sector

Consumption of energy in China reached 1388 million tons of coal equivalent (tce) in 1996, making China the second largest energy user in the world after the United States. Energy consumption in China is growing at an annual rate of 5 to 6 %, compared to the annual GDP growth rate in the range of 10 % during the last 15 years. The primary source of energy in China is coal, which currently accounts for 76% of the total commercial energy use. Oil provides about 16%, with hydro power (5%) and natural gas (2%) accounting for the rest. Fossil fuels thus provide 94% of the commercial energy in China. Coal use is forecasted to triple by the year 2020 in line with economic growth, and the consumption of oil products is also expected to rise rapidly.

The combustion of fossil fuels has led to serious local and regional environmental problems, notably air pollution but also increasing water and even land pollution. The pollution is exacerbated by inefficiencies in energy production and transmission, and by the poor quality of coal. For example, pulmonary disease, which is closely related to particulate pollution, is itself the largest single cause of adult deaths in China, accounting for 26% of adult deaths. Air pollution also contributes to acid rain, which is causing increasingly serious damage to forests, crops and aquatic life in southern China.

China's fossil fuel based energy structure also implies high and rapidly increasing CO_2 emissions. China currently accounts for about 13% of global energy related CO_2 emissions, and its relative share is rising -as is the case with most developing countries. The volume of CO_2 emissions is expected to surpass that of the United States within 10-15 years from now, making China the world's largest source of greenhouse gases by the year 2015.

Renewable energy sources could offer an environmentally sounder alternative to fossil fuels. The development of renewable energy in China could help mitigate the growing local environmental and health concerns associated with pollution from fossil fuel energy sources, as well as the global concerns.

Additionally, renewable energy sources can promote socio-economic development in remote or poor areas which have no access to the electricity grid. In Inner Mongolia for example, human settlements are scattered to enable animal husbandry and prevent over-grazing. There are still 1620 hamlets and more than 400,000 families not electrified. In China there are 70 million people living in remote areas without electricity.

China has one of the best renewable energy resource endowments in the world. National wind resource potential exceeds 255 gigawatts (GW). Solar insolation is excellent, with 17 million Mtce (or 50,000 EJ) of solar energy absorbed at the surface annually. Hydro, biomass and geothermal resources are also abundant in some provinces, with potential annual resources of 300 Mtce of biomass for energy purposes, 76 GW for mini-hydro (less than 25 MW) and 6.7 GW from geothermal energy.

Despite this rich potential and its associated environmental and social benefits, renewable energy sources in China remain on the margins of the energy sector. Only small hydro power is fully commercial in China, with an installed capacity of 15 GW in 1993, representing 8% of the total national generating capacity. Other renewable energy sources, in contrast, make up only a marginal share of China's energy supply. At the end of 1997, China had 14 grid-connected windfarm sites with a total installed capacity of 150 MW, and over 140,000 small wind turbines (50 to 5,000 W) with a combined off-grid capacity of 17 MW. There is a domestic manufacturing base for small-scale wind turbines, although there is no capacity for large turbines for 200 kW and greater. In 1994, the installed capacity of photovoltaic cells (PV) was only 3 MW, with about a

third in dispersed household systems. Lastly, there is only 30 MW of installed geothermal generating capacity and about 800 MW of biomass-fueled power systems.

Until now, development of renewable energy technologies (RET) has focused largely on research and pilot demonstration in China. Consequently, the market for renewable energy sources is poorly developed, and renewable energy is not yet financially viable. In the absence of a critical minimum demand, investors are hesitant to invest in manufacturing or operating renewable energy systems. Because of the limited number of units produced, the prices of small-scale technology such as PV are too high, when available, and consumers are unwilling or unable to pay.

However, a recent WB/GOC study on *"Renewable Energy for Electric Power"* concludes that many renewable energy technologies are almost ready to compete in the open market with traditional energy sources. If measures were taken to 'level the playing field' - that is removing some of the economic and institutional barriers and pursuing R&D - many of these technologies could be competitive in certain regions of China within a short time.

Furthermore, the UNDP/WB/GOC study on *Issues and Options For GHG Emissions* funded by the Global Environment Facility (GEF) demonstrates that minor assistance to the energy sector could make a significant difference to the make-up of the sector in the near future. By strategically helping to level the playing field, international assistance could release the potential of renewable energy and make a big difference to China's environment and GHG emissions. According to the study, a baseline scenario, in which little or no additional action to promote renewable energy is taken, will lead to new and renewable sources of energy (excludingt large and small hydro power) accounting for less than one percent of electricity used in the year 2020. With moderate action, however, the Chinese economy could draw as much as 6% of its power supplies from renewable energy sources (excluding large and small hydro power).

2 Host Country Strategy

China is a party to the Framework Convention on Climate Change, and is in the process of formulating policies to address global climate change concerns. Several studies have been undertaken, including one by the Asian Development Bank (ADB/SSTC, 1994) and the UNDP/WB/GOC study mentioned above. These studies urge that an aggressive programme be implemented to develop renewable energy sources in China.

Accordingly the State Economic and Trade Commission (SETC), the State Development and Planning Commission (SDPC, formerly SPC) and the Ministry of Science and Technology (MST, former SSTC) recently prepared a *"Program on New and Renewable Energy Development in China (1996-2010)"*, which aims to rapidly expand the use of these energy sources throughout the country. The State Council has approved the programme, and the commissions are preparing implementation plans. The *Program on New and Renewable Energy Development in China* gives a general development framework, while plans of the State Electric Power Corporation (formerly the Ministry of Electric Power (MOEP)) and the Ministry of Water Resources (MOWR) provide more concrete targets. Table 1 summarizes the specific targets.

Table 1. Current and Future Installed Capacity of Renewable Energy Sources for Power (MW)
Sources: SDPC, SETC, and SSTC (1996). The Program on New and Renewable Energy Development in China: 1996-2010. Unpublished report. The State Electric Power Corporation (1995). Unpublished report.

	1993	2000	2010	2020
Technology	Actual	Projected	Projected	Projected
Wind	30.0	1,000	3,170.0	8,500.0
Solar PV	3.0	35.0	200.0 (PV & thermal)	500.0 (PV & thermal)

Geothermal	30.0	106.0	200.0	330.0
Solar Thermal	0	35.0	NA (included in PV)	NA (included in PV)
Biomass[1]	800	N/A	N/A	N/A
Ocean	6.0	40.0	200.0	400.0
Total	869	1,216	3,770	9,730

N/A. = not available

Note: The "Program on New and Renewable Energy Development in China" calls for a target for biomass power generation capacity to reach 50 MW by 2000, and 300 MW by 2010. This project is obviously too conservative in that it projects less biomass capacity in the future than already exists.

Meeting the above targets, particularly for the year 2000, will require a concerted effort, and GOC is now looking to widely disseminate the most promising technologies. In the past, new technologies have been successfully disseminated using the national budget through centralized programs. The present fiscal climate limits such an approach. Consequently GOC is looking to complement these with a market-oriented approach to further develop, disseminate and commercialize renewable energy technologies. This is in line with the findings of international analysts which indicate that increasing the market orientation of the economy is central to China's efforts to improve the efficiency of use of all resources, including energy.

GOC has taken steps on an ad-hoc basis. For example, China provides preferential incentives for the formation of joint ventures between Chinese and foreign companies in the form of tax policies and low interest loans (less than 6%). Some of these incentives are presently supporting wind turbine manufacturing and market development in China.

In order to further support the market-oriented approach, the Government of China has taken steps to streamline the role of Government and to strengthen coordination amongst government agencies. As part of an overall government restructuring, in March 1998, the Government announced new mandates for national agencies involved in renewable energy (see A4 below for details of the new mandates).

3 Prior and Ongoing Assistance

International assistance to the energy sector in China has been a priority over the past decade, with large scale ODA and FDI investment. Although almost all of this has focused on development of the traditional fossil fuels, a number of renewable energy projects have been supported by multilateral and bilateral organizations. These projects have focused on establishing the technical performance of energy systems in specific locations, such as wind turbines in Inner Mongolia, PV cells in Gansu Province, or geothermal facilities in Tibet. For example, since 1979 UNDP has supported 8 projects, totaling US$ 9.8 million, to introduce wind power, geothermal and PV technologies in China. Even with this support, the technologies face stiff competition in the market, and the market for renewable energy remains undeveloped.
A major policy initiative for the development of alternatives to coal burning in China was the above-mentioned GEF/UNDP/WB study entitled "Issues and Options for Greenhouse Gas Emissions Control in China". It helped identify both priority energy efficiency projects and the need for further work on renewable energy development. This study also identified a main challenge as being the need to assemble effective packages of policy reform, investment and institutional strengthening measures to reduce barriers to new technologies.

In line with the findings and recommendations of this and other recent studies, several policy implementation and investment initiatives are under preparation or starting.

(1) UNDP has a programme of ongoing and pipeline projects to support the commercialization of renewable energy, including:

An $125,000 ongoing *Resources Concessions for Sustainable Development of Renewable Energy in China* focuses on policy implementation, in particular, wind energy. It aims to establish a framework for resource concessions which will include the necessary regulatory, financial and institutional components. This will lead to policy recommendations, including proposals for renewable energy regulations and model power purchase agreement.

A $517,500 ongoing project is on *Geothermal Development to Meet the Basic Needs of the Population of Nagqu Town in Tibet.* The objective of the project is to develop geothermal energy, by removing barriers and demonstrating technology. It also develops local capacity in Nagqu (Tibet). The project determines a way to have technically, financially, managerially and environmentally sustainable geothermal energy in Nagqu. The lessons learnt from this project will be of relevance to all new and renewable energies, particularly village size and grid-connected.

A pipeline project aims to develop a *National Energy Strategy and Plan.* This will identify energy-related issues/strategies in China and set options for energy policy development. By drawing together all the recent experience in renewable energy, and using this to develop an energy sector plan, the project will promote renewable energy technologies in the overall energy sector. Decision-makers should become less averse to the risks of renewable energy technologies. Implementation is scheduled to begin in early 1999.

At the demonstration level, UNDP is securing funding through the UN Foundation to promote *Modernized Biomass Energy in Jilin Province*. The project is to help demonstrate modern technology to generate power and electricity from biomass, and to develop village-based, grid-connected biomass electricity generators appropriate to the Chinese context. The project also addresses financial and institutional barriers to biomass energy.

(2) A pipeline World Bank/SETC initiative to develop a GEF/World Bank renewable energy development project in China. The World Bank project will directly complement and further expand the activities to be carried out by the present GEF/UNDP project. The GEF/World bank project objective is to promote long-term commercial markets for windpower and solar PV. The project will strengthen market based financing mechanisms and commercial infrastructure to promote the technologies for widespread application. The proposed project will consist of four components: i) installation of 200 MW of Independent Power Producers (IPP) windfarms financed with domestic equity and domestic and foreign debt; ii) sales of 200,000 PV solar home systems by private firms; iii) technology innovation to reduce cost and improve performance of windfarm and solar PV technologies in China by supporting domestic manufacture and assembly; and iv) strengthening of institutional capacity to support the development of required policies, institutional frameworks, business skills and project management. The total budget of this project will be US $ 370 million with $35 million contributed by GEF. The project will last about five years starting in early 1999.

(3) In addition to these policy reform and investment initiatives, several large technology transfer activities are on going or completed, including:

(i) The Sino-German Renewable Energy Cooperation Programme in Inner Mongolia: The main objective of the programme, which started in 1990, is to develop wind and solar energy for electricity supply in remote areas in Inner Mongolia. The programme notably has developed technologies for combining wind, PV, diesel and batteries in one system. These systems were successfully demonstrated in 16 villages and more than 100 herdsman families.

(ii) The Sino-German Wind Energy Programme: This US$ 7.5 million project, started in 1995, is assisting Hainan Wind Power Company in Haikou and Zhejiang Wind Power Development Company in Hangzhou.

(iii) The Sino-French Rural Electrification with Solar Energy in Xinjiang Province: This US$19 million programme aims to supply electricity to villages in Xinjiang Province by using solar photovoltaic energy to increase the standard of living in rural areas.

(iv) The Sino-USA Wind Energy Mapping: The objective of this USEPA-supported project is to show Chinese officials potential sites for individual and distributed wind energy systems in China.

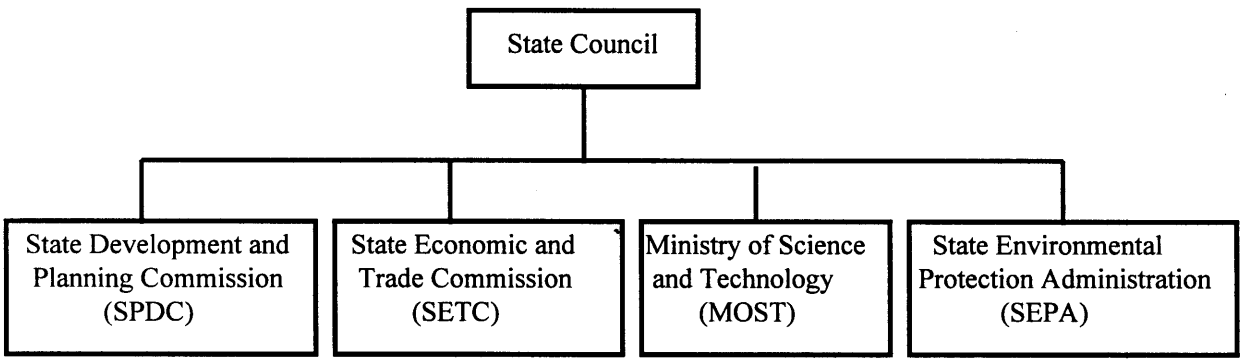
(v) Strengthening the Chengdu Biogas Research and Training Centre, CPR/81/003 (UNDP, completed)

(vi) Danida supported (loan) projects providing windfarm technology to generate electricity for Urumqi in Xinjiang province.

(4) A $3.5 million regional UNDP Programme for Asian Co-operation on Energy and the Environment (PACE-E) was carried out during 1993-1997. The programme provided a catalyst for countries in Asia to identify and solve, on a co-operative basis, energy-environmental problems. Two specific components are particularly related: Energy-environmental planning and Rural energy-environment development. Some innovative activities such as micro-financing and micro-enterprise loan portfolio was conducted during project implementation.

4 Institutional Framework for the Sub-sector

The State Council, headed by the Premier, acts as the executive of the Chinese National People's Congress. It co-ordinates the work of government commissions, ministries, administrations, bureaus, offices, and state-owned corporations. The various Commissions under the State Council are in charge of planning government projects in their respective areas. The ministries are in charge of implementing and managing the projects. Under the State Council, four national agencies are actively involved in renewable energy: the State Development and Planning Commission (SDPC), the State Economic and Trade Commission (SETC), the Ministry of Science and Technology and the State Environmental Protection Administration (SEPA)[1], as illustrated in the chart below



The SETC is in charge of industrialization and retrofitting existing industries. The Renewable Energy Division and the Energy and Material Saving Division are under the Department of Resource Conservation and

[1] In April 1998 the State Planning Commission (SPC) became the State Development Planning Commission (SDPC), the State Science and Technology Commission (SSTC) became the Ministry of Science and Technology (MOST) and the National Environmental Protection Agency (NEPA) became the State Environmental Protection Administration (SEPA)

Comprehensive Utilization. SETC has made available 120 million RMB for low interest loans to support renewable energy projects in China, to be used for manufacturing and demonstration projects. China has additional incentives for the formation of joint ventures between Chinese and foreign companies in the form of tax incentives, low interest loan funds (less than 6%), and local autonomy for projects less than 50 million RMB in special economic zones. Some of these incentives are presently supporting wind turbine manufacturing and market development in China.

The SDPC is in charge of macro-planning and budget approval. Renewable energy development is handled by the Energy Conservation and New Energy Division under the Department of Transportation and Energy. The SDPC also approves financing and foreign exchange requirements for large renewable energy projects.

The MOST is in charge of planning and program administration of scientific research and development (R&D) projects. The MOST is also in charge of technology transfer, including acquisition of foreign technology. It supports manufacturing actively through the provision of venture capital.

In addition to the three above agencies and their associated research institutes, SEPA is responsible for all aspects of environmental policies, the formulation of the national environmental regulations and issuance of the national environmental quality standards. SEPA is entrusted by the State Council for the enforcement of the regulations and standards and co-ordination of the important environmental programs and projects. In recent years, SEPA has been involved in the renewable energy development programs as they are seen as a way to protect the local and global environment. SEPA also assists the Ministry of Finance as the Chinese Focal Point for GEF issues.

In principle, SDPC oversees large infrastructure projects, while the SETC oversees upgrading of existing industries, and the MOST oversees R&D. However, the New Energy Division of SDPC, the Renewable Energy Division of SETC, and the Energy Division of the MST can have overlapping authority with respect to renewable energy projects, and sometimes have operated in a competitive environment. In recent years the working relationship between these three divisions has improved. One example is their joint effort in developing China's Agenda 21, "White Paper on China's Population, Environment, and Development in the 21st Century," and a *National Programme New and Renewable Energy Development* for the period of 1996 to 2010.

Each of these three national Agencies has representatives in each province. These provincial agencies report both to the State Agencies and to the provincial Governments. In addition, each agency is strengthened by an associated research institute. For example, the Centre for Renewable Energy Development (CRED) was set up in 1996 as a branch of the Energy Research Institute (ERI) of the SDPC. CRED is now the major research center involved in renewable energy development in China.

B. - PROJECT JUSTIFICATION

1 Problem to be addressed: the current situation

Renewable energy sources could offer an environmentally and socially sound alternative to the increased use of coal in China. Ongoing programmes in China provide technical support to investors, manufacturers and users of RETs. However, for renewable energy resources to make a significant contribution to the sustainable development of China, the following non-technical barriers to their widespread commercialisation will need to be removed:

1. Limited scale of existing investments in renewable energy technologies: To date, renewable energy projects are essentially pilot or demonstration projects, relying on grant, soft loans and support from local

authorities. For renewable energy to make an appreciable contribution to sustainable energy development in China and for the industry to generate economies of scale to reduce production costs, a development programme of an internationally unprecedented size will be required. As an illustration, one percent of primary commercial energy supply in China in 2020 will be equivalent to the base-load output of at least 16,000 MW of electric power plant capacity, requiring an investment in the range of US$ 15 to 30 billion. Current investments in the RE sector fall short of this mark.

2. Lack of familiarity with successful market-oriented efforts to commercialise RETs: Few policy makers and professionals are familiar with legislation and regulations which resulted in substantial investments in renewable energy development in other countries such as Denmark, Germany, India, the Netherlands, U.K. and U.S.A. While several pilot projects have already successfully demonstrated the technical performance of RETs, the potential of market-oriented approaches to develop renewable energy remains to be established in China.
3. Limited awareness of investment opportunities in RETs : To date RE investment opportunities remain obscure and undifferentiated from other rural and small resource utilisation opportunities. In addition, they are often perceived as a high-risk and low-return investment by potential investors. There is no facility to collect and provide potential project proponents with easy access to RE investment information in China.
4. High up-front costs and lack of access to credit: Although RE alternatives can have very low operating costs - and thus lower life-cycle costs than conventional alternatives - the high initial capital cost of the technology often forms an insurmountable barrier to its users, particularly for small rural energy users. Individual households and small rural communities, which is a large untapped market for renewable energy, frequently are unable to access the necessary credit to cover the up-front costs for such projects.
5. Incomplete assessment of renewable resources: Current knowledge of the quantity and distribution of renewable resources and the data collecting system for renewable resources assessment are largely inadequate, particularly data on wind regimes and solar insolation levels in much of the country. This limited information poses a serious constraint to policy formulation and investment promotion. Where data do exist, they are often gathered by meteorological offices on an infrequent basis at locations not necessarily suitable for wind or solar applications. However, siting wind or solar facilities requires the availability of continuous data over several years in order to minimize the risk of resource unavailability.
6. High transaction costs: RE technologies, particularly off-grid electricity and thermal applications, are often small and decentralised. This leads to proportionally higher transaction costs on investment for renewables compared to conventional centralised sources. The transaction costs per kW for a central coal plant are lower than the sum of the costs of the many thousands of transactions required for comparable capacity from solar home systems. Faced with the choice, investors are wary of the latter.
7. Lack of standards and testing facilities for equipment: In many countries, early enthusiasts who installed renewable energy facilities found that the equipment did not live up to expectations. The manufacturers of such equipment were usually small companies that did not make use of the experience that had been gathered world-wide. As a result, there has been public scepticism about the viability of renewable energy systems. The low quality of renewable energy equipment and the resulting lack of consumer confidence have been shown to be an important barrier to the adoption of renewable energy technologies in China. For both small off-grid systems and large grid-connected systems (especially with mid-sized wind turbines), a lack of standards and codes of practice increase the perceived risks of consumers and investors in RE. Industry compliance with standards increases confidence in the product and hence the market.
8. Poor linkages from R&D to commercialisation: Chinese RE technology designs, with some exceptions such as the evacuated tube solar hot water system, have not been widely commercialised in the Chinese market. Research institutes, while providing highly competent researchers, are not equipped for the production and marketing function. Few professionals familiar with the state of the art in several RETs have any more than a passing familiarity with market finance, commercial enterprise operation, and economic project appraisal. However, in the absence of strong linkages with the business community, they often take on this role with mixed success. Without a strong marketing function, technology developments in one region which could have wider applications, are often not widely transferred.

2 Expected outcome by the end of project

It is expected that at the end of the project:

1. Market-based Instruments such as (i) concessionary financing arrangements; (ii) targeted, but market value, credit lines; (iii) tax relief to investors; and (iv) standardised Power Purchase Agreements (PPA) will have been developed to increase the financial attractiveness of RETs to potential investors/consumers over the short-term and expand the RE market in China. Market-based companies such as Independent Power Producers (IPP) and Energy Service Companies (ESCO) will have been established to attract larger players and substantially increase private investments in the renewable energy industry.
2. Pilot projects will have been established to provide national policy-makers and businessmen with first-hand knowledge of market-based instruments and institutions and demonstrate the potential of market-oriented approaches to develop RETs in China. Linkages established through the project will ensure that those implementing pilot projects benefit from the guidance of the national level agencies. Likewise the linkages will ensure that the national level policy-makers carefully account for the findings in the pilot projects. International study tours to visit operating examples and in-country training will have been organized to further enhance the exposure of national policy-makers and businessmen to market-based instruments and market-based institutions.
3. Alternate financing mechanisms will have been explored to overcome RE high front-end costs for individual households and small rural communities. The role of ESCOs in making credit available and in marketing the services of RE will have been demonstrated in pilot sites and the results will have been widely disseminated in China.
4. The demand and supply for credit for small energy users, particularly for hybrid and biogas systems in the project areas, will have been assessed and appropriate recommendations to set-up funds for renewable energy submitted to Government.
5. Awareness of RE investment opportunities will have been raised. An industry association, the Center for Renewable Energy Industries Association (CREIA), will have been created with the support of the project to collect and provide information about RE investment opportunities and returns on existing RE investments. CREIA will provide this information through an Investment Opportunity Forum on the Web and through regional networking meetings. CREIA will also act as a forum between regulatory authorities, research institutes and industry professionals and will endeavour to bring together project proponents and investors.
6. A national renewable resource assessment will have been carried out and the database will be accessible free of charge to potential project proponents on the web. The database will be established and maintained by the Project beneficiaries. The database will be made widely accessible, e.g. to CREIA.
7. Transaction costs will have been lowered by "packaging" small investments. Pilot projects using ESCOs and IPPs will demonstrate the ability of these mechanisms to increase investment opportunities by bundling small user investments. Transaction costs will have been further lowered by giving investors easy access to investment information maintained by CREIA and on the database.
8. Standards will have been developed for the manufacture and installation/commissioning of four RETs (solar hot water heaters, intermediate wind turbines, industrial scale biogas and bagasse systems). Standard-setting methods will be within the existing capacity of energy research institutes across China so that compliance can be readily established. These standards will be set in collaboration with industry and receive a high level of co-operative agreement. Certification procedures will have been set in place for a popular consumer technology, solar water heaters, to increase their consumer acceptance.
9. R&D-to-market linkages will have been improved. Generic and appropriate designs will have been developed and/or compiled for hybrid (PV, wind) systems, biogas and bagasse cogeneration. These will have been widely promoted and distributed within the RE development and investment community with the assistance of CREIA.

All the above will have been developed and tested over several sites for five RETs.

3 Target beneficiaries

The indirect beneficiaries of the project will include :

- A large number of Chinese who will not face the adverse consequences of local pollution and adverse health consequences of mining and using coal. The technologies promoted as a result of this project will back out significant amounts of coal in power generation, industrial boilers and thermal applications.
- People who will enjoy the benefits of improved water quality and water conservation achieved as a result of biogas digesters in thousands of industrial units, wineries and pig farms. Similarly, benefits of better environment and improved water quality will accrue to those living close to bagasse cogeneration plants.
- The ultimate beneficiaries will be the citizens of the world who will benefit from the reduced GHG emissions and adverse impacts on natural ecosystems.

The direct beneficiaries of the project will be Chinese professionals, policy makers and businessmen who will be exposed to market-friendly mechanisms for the commercialisation of renewable energy forms.

Staff in Government agencies, particularly SETC, MOST, SDPC and SEPA and their provincial affiliates and research institutes, will be the most direct beneficiaries of the training programme and capacity building initiatives. Government renewable energy policy analysis and technology research agencies will directly benefit from exposure to recent international experience in market mechanisms for the private sale of energy and to best practice renewable energy technology applications.

The renewable energy private sector will benefit from the networking, opportunities for investment, access to new technologies and information, reduced risks, and improved institutional arrangements which the project supports.

A large number of poor Chinese in rural areas who will benefit from access to high quality energy for meeting their basic needs as well as for their productive purposes. These people will benefit from the pilot projects and from a large number of investment projects which will become financially viable as a result of policy and institutional changes and a favourable environment for attracting foreign capital, assistance from External Support Agencies (ESAs) and bilaterals.

4 Project Strategy and implementation arrangements

4.1 Project Strategy

The overall strategy of the project is to strengthen the capacity of China to shift from supply-oriented, state-supported technology deployment to demand-driven, investor and consumer-friendly approaches to increase investment in renewable energy technologies.

Under central planning, the Chinese approach to any form of technology development was to create manufacturing and technological infrastructure as a prelude to the "popularization" of a given technology. The technology was then disseminated through a combination of developing technology packages, staffing local offices to provide technical backstopping to end-users and providing state credits to participating communities. Neither the Chinese Government nor local governments have the resources to further support this approach to technology deployment.

The project will develop national capacity to implement an alternative approach to technology deployment which would be consistent with the current socialist market-oriented economy and which would make use of similar activities, but in the reverse order: The first step would be the creation of demand for the technologies and the services they provide--the second step would be the enhancement of supplies to meet that demand. The successful experiences of other countries has shown that once the demand for a technology is created, meeting that demand through indigenous production is a relatively straightforward second step. This approach has been used to accelerate the adoption of renewable energy in a number of developed and developing economies, including the United States, the United Kingdom, Denmark, Germany, India and the Netherlands. A similar approach could also prove successful in China should the national market for renewable energy be strengthened.

The rate of return and the degree of risk perceived are the two main components of an investment decision-making. To strengthen the national market, the project will aim to increase the rate of return and reduce the perceived risk of investments in RET for both consumers and producers. The project will develop market-based instrument to increase the financially attractiveness of investments in RET to both investors/consumers, including: (i) concessionary financing arrangements; (ii) targeted credit lines; (iii) tax relief to investors; and (iv) Power Purchase Agreements (PPAs). However the project will take care to ensure that no unsustainable financing mechanisms are established. Where forms of 'subsidies' are used, this is clearly seen as a short term measure to level the playing field vis-a-vis other forms of energy. In the long term, the institutional and legal mechanisms developed through the project will lessen the need for any form of subsidy. For example, the project will also promote market-based institutions such as Independent Power Producers (IPPs) and Energy Service Companies (ESCOs) to attract larger players in the renewable energy industry. CREIA will also develop into an institution to support investment in RET.

To decrease the risk of investments in RE technology, the project will: (i) carry out a resource base inventory for renewable resources; (ii) identify market potential and investment opportunities; (iii) improve access to information for decision-makers, (iv) develop national capacity for standardisation and certification of technology; and (v) demonstrate technologies with near and mid-term market potential.

To provide hands-on experience with a particular instrument/institution and demonstrate its validity as an administrative and financial mechanism, the project will established a number of pilot projects to remove barriers to the dissemination of five promising RETs, namely: (i) rural electrification by solar and wind hybrids; (ii) wind farm development; (iii) biogas production; (iv) bagasse cogeneration; and (v) solar-water heaters. The selection of technologies has been made in consultation with the Chinese authorities and collaboration with the World Bank and UNDP/GEF on the basis of recent assessments of market conditions and potential for future GHG reductions.

Three of the five technologies selected (windfarm, biogas, bagasse) represent renewable power applications for on-grid generation of power. This emphasis reflects the increased understanding from the experience of other countries of the market and policy conditions necessary for a rapid commercialisation of these applications. They also pose the most significant potential reductions in GHG emissions. However, the fourth technology-- solar and wind hybrids-- represents a relatively new undertaking into the provision of electricity services to people living in areas where the electricity grid is not accessible. While a number of barriers remain in the widespread expansion of this technology to rural China, it has considerable promise to meet the electricity needs at small and medium rural load conditions with little or no GHG emissions. The fifth technology, solar water heaters, is already being disseminated through market mechanisms, but has encountered a barrier in the form of inconsistent product quality. The project activity for this technology will focus only on the development of standards and certification procedures.

The project will build on and complement the UNDP programme for energy/renewable energy in China. This programme is supporting the government to develop the tools, skills and capacity to implement RET policy.

Also, the renewable energy projects focussing on wind, geothermal and biomass energy will provide many useful lessons regarding the commercialization of renewable energy.

In addition, the pipeline UNDP/TRAC project is to address energy policy in China with a heavy emphasis on the promotion of renewable energy. Despite a generally supportive policy in China, many energy sector decision-makers continue to focus on traditional energy supplies and technology. By drawing together all the recent experience in renewable energy, and using this to develop an energy sector plan, the project will help promote renewable energy technologies in the overall energy sector. Decision-makers should become more willing to invest in renewable energy technologies.

Training of national policy makers, sector professionals and businessmen; data collection and information exchange; and close consultation between regulatory authorities and the business community in the creation of standards and code of conduct for RETs are major components of this project. To assist in implementing these activities in a cost-effective manner, the project will strengthen the capacity of the beneficiary agencies and support the establishment of the China Renewable Energy Industries Association (CREIA). The project will help to develop a five-year business plan for CREIA to ensure its financial sustainability.

Because China is the largest country in the world, the scale of assistance required to move toward full commercialisation of renewable energy is immense. While this project may be expected to remove many of the identified barriers, it cannot remove them all. Some barriers will only become apparent as these recognised barriers are removed. There will continue to be a need for further investment and technical assistance to remove all of the barriers to renewable energy deployment through market mechanism. Therefore, this project should be viewed as an important first step for the international community to help China down the road to sustainable development through the market-based deployment of renewable energy. To further assist in this process, this project will be used to catalyse as much additional donor support and private resources for renewable energy activities in as possible. A particular attention will be paid to coordination, information exchange and renewable energy promotion.

4.2 Implementation Arrangements

The project will be executed by UNDESA. The executing agency shall be responsible for procurement and payment of all services, subcontracts and equipment in accordance with UN rules and procedures. UNDESA will also be responsible for technical and financial reporting to GEF through the UNDP China office.

UNDESA will be supported on technical issues by the *Energy and Atmosphere Programme* (EAP) of UNDP. EAP will assist in identifying and selecting all international experts for the project. EAP will also participate in the selection of all sub-contractors. (See Annex 7)

A project *Advisory Group* (AG) will be established, consisting of: all project donors, Ministry of Finance, and the executing and implementing agencies. The World Bank will also be invited to join the AG in order to ensure optimal coordination between this project and a related World Bank/GEF renewable energy project. The Advisory Group shall meet twice per year, either in Beijing or at project demonstration sites. The functions of the Advisory Group will be to (i) review six-monthly progress reports (ii) review brief documents outlining project strategy and targets for the following six months; and (iii) provide general advice to the project. TOR for all major sub-contracts (demonstration projects, international experts, and training) will be submitted to the members of the AG for their comments prior to finalisation.

The project will be implemented by SETC with assistance from SEPA. SETC shall appoint the National Project Director (NPD). The NPD shall be responsible for coordinating the delivery of all GOC inputs to the Project and for ensuring that they are delivered in a timely fashion.

A Project Management Office (PMO) will be established in Beijing to assist the day-to-day management of the project. As delegated by the NPD, the roles of the PMO will be to: (i) assist the NPD in the day-to-day management of the Project; (ii) prepare all workplans and reports, quarterly, semi-annual and annual; (iii) prepare the terms of reference for all project inputs (sub-contracts, international experts, international and in-country training. etc) and assist in the management and monitoring of their implementation (iv) prepare all documentation for the twice yearly meetings of the AG, organise the meetings, and act as secretary to the meetings. The PMO will be staffed by four full-time professionals: one national Project Coordinator, one international Senior Technical Advisor and two UN technical volunteers (draft TOR for the international personnel are given in Annex 4).

To facilitate project management, the project is designed to rely largely on sub-contracts to implement activities and deliver outputs. Sub-contracts will be issued by the Executing Agency through competitive bidding on the basis of terms of reference developed by the PMO. Sub-contracts will be used both for national level activities and the pilot activities at local level. Outline TOR for each sub-contract is included in Annex 3.

At the local level of the pilot projects, the Provincial affiliate of SETC (the Provincial Economic and Technology Commissions - PETC) will be responsible for coordinating all activities and mobilising the local agencies and Government inputs.

The implementation arrangements are displayed in chart form in Annex 2.

5 Reasons for assistance from UNDP

Environmental protection is an overriding priority of UNDP, along with poverty alleviation, governance, job creation and women's participation. This project will address environmental issues at both local and global levels. The local environmental benefits will be in terms of reduced air pollution, reduced water pollution and improved water conservation. The health benefits from reduced pollution will improve the quality of life of millions of Chinese in rural and urban areas.

With the Nairobi Conference on Renewable Energy in the early 80's and again as a follow up to the Rio Conference in 1992, the UNDP reinforced its commitment to sustainable energy development and, as a subset, renewable energy. The foreword to the 1997 UNDP publication Energy after Rio: Prospects and Challenges states:

> *Agenda 21 called on nations to find more efficient systems for producing, distributing and consuming energy, and for greater reliance on environmentally sound energy systems, with special emphasis on renewable sources of energy. UNDP through its Initiative on Sustainable Energy is assisting programme countries to reflect these objectives in national energy policies, investment plans and sustainable development strategies. Change, however, must go beyond aid policies and be reflected in international business, investment, trade, public and private sector policies and decisions.*

The objectives, strategies and expected outcomes of this project do much to advance the goals of the Initiative on Sustainable Energy.

The project will also contribute to the UNDP objective of poverty alleviation and employment creation, particularly for women, by facilitating the provision of electricity services to millions of rural Chinese for improved quality of life and livelihood activities. Electrification of rural areas has historically been one of the

initial and necessary steps leading to development. Rural electrification will notably facilitate the emergence of micro-enterprises in rural areas which are likely to have a particularly positive impact on women's income.

One of the major components of the project is capacity development of Chinese professionals. A large group of national experts, as well as the Chinese investment and business community, will be trained in this important area and an informal network in this area will develop. This will ensure that the process started with this project will be sustained and disseminated in the country.

UNDP has extensive experience in providing technical assistance to China's environmental protection and energy development. Through its executing agency, UNDP will introduce appropriate technical and managerial experience developed in other countries to reinforce China's own effort for environmentally responsible development.

6 Special considerations

The project will create a positive environment for greater participation of the private sector, both domestic and international, in this growing sector of the Chinese economy. The promotion of foreign investment is *de facto* the promotion of greater participation of private enterprise in the international economy.

In addition to the ultimate impact on women described above, the project will ensure that at least 30% of all training participants are women.

Renewable energy is an area where, comparatively, a great depth of experience and knowledge lies in other developing countries, for example India, Indonesia and Brazil. The project therefore lends itself to providing technical co-operation among developing countries (TCDC), another UNDP priority area. Where possible, all project study tours and overseas training will be to/in other developing countries and will be seen as a two-way information exchange, this way the countries can also benefit from China's ongoing experience. The project will also invite delegates from other countries to participate in the major project workshops, and efforts will be made by the project staff, UNDP and the Executing Agency to identify funding for this participation. The project will also assist other developing countries by making available results of studies and analyses of various policy options and their effects on the commercialisation of renewable energy.

One key to development of this sector in China is the development of information systems and ensuring a full access to information. This project will therefore have several components to promote information exchange. For example, the China Renewable Energy Industry Association will be established to promote investment and disseminate information on renewable energy in China. Mechanisms such as the Investment Opportunity Facility and a National Renewable Energy Database will serve as useful tools to promote further information dissemination. Newsletter, a website, and the use of business journals and other media will be the specific information dissemination tools. All these mechanisms will be sustainable and continue after the project.

7 Coordination arrangements

The creation of a Project Management Office (PMO) ensures a strong internal coordinating function. The use of advanced electronic communication technology such as the creation of Internet websites will ensure an easy access by all concerned agencies to the information collected by the project and will further enhance co-ordination.

The regular meetings of the AG will ensure coordination with other internationally assisted projects, in particular the related World Bank/GEF Renewable energy project (CN-PE-46829, CN-GE-38121). And at the local level, the PETCs are responsible for the coordination of the pilot activities with other related projects. Donor participation in the Project will facilitate co-ordination with other bilateral RE activities.

Coordination with related UNDP projects in China will be ensured through the UNDP Country Office.

8 Counterpart support capacity

SETC has the experience and authority necessary to act as the implementing agency of the project. In 1987 the Department of Resources Comprehensive Utilisation and Conservation was established within SETC to provide policy-making and project support to RE State programs, with primary responsibilities for project identification and financial arrangements.

Since then they have supported over 100 projects with a budget of 20 million yuan. Technologies have included biogas, solar PV and hot water and wind farm development. SETC has been responsible for oversight of the formulation of China's renewable energy strategy and program up to 2010, and also works regularly with other multilateral and bilateral donors such as the World Bank and USDOE on the formulation of key background studies and aid programs. SETC has counterpart provincial (PETC) and county-level agencies to help direct and implement policy. This regularly includes:

- selection of implementing agencies;
- project management and monitoring of projects; and
- identification of project priorities.

SEPA has been chosen to assist SETC with implementation because of its role at the State level in linking energy concerns with the environment. It was responsible for formulation of China's Action Plan for Agenda 21, in which renewables play a prominent role in GHG reduction. They have been responsible for regulatory mechanisms directly affecting RE technologies, such as limits and levies on industrial effluent which can be removed with biogas technology.

C.- DEVELOPMENT OBJECTIVE

The development objective of the project is the widespread adoption of renewable energy sources in China by removing a range of barriers to increased market penetration of the technology.

D.- IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES

There are two immediate objectives in this project. Each immediate objective has several outputs and activities that are described below. The activities for each output often run in parallel with those for other outputs; others are in sequence to each other. The sequence of activities for each output is explained in Annex 1, the Workplan.

1. Immediate Objective 1:

National capacity developed for the rapid commercialisation of renewable energy systems in China.

1.1 Output 1:

A sound operational basis for the Project established.

Success Criteria

The success of this project will be measured as follows: (i) Timely and high quality performance reports; (ii) Timely and accurate financial statements in conformance with UNDP financial practices; (iii) Smooth and coordinated implementation of different Project Activities reflected in a high delivery rate.

Activities for Output 1	Responsibility
1.1.1 Establish a Project Management Office (PMO).	SETC/UNDESA
1.1.2 Prepare a detailed draft workplan and inception report for both Objectives 1 and 2. .Identify resource requirements, responsibilities, task outlines, performance evaluation criteria and workplans/ schedules. Create outlines of terms of reference and qualifications for each subcontract.	PMO/SETC
1.1.3 Organise an Inception Workshop to present the report to financial contributors and recipient agencies and to discuss reporting requirements.	PMO/SETC
1.1.4 Based on the agreed workplan, prepare detailed 6 monthly workplans to be submitted to the NPD and executing agency. Organise and prepare for the biannual meetings of the Advisory Group.	PMO
1.1.5 Rapidly prepare a user-friendly database of all internationally assisted projects on renewable energy in China	PMO
1.1.6 Prepare a newsletter (quarterly) to communicate the project's findings and successes. Establish a project website in order to communicate with the Chinese and international community.	PMO

1.2 Output 2

Strong institutions to serve as focal points for accelerating market penetration of renewable energy technology.

Success Criteria

The success of this Output will be measured as follows: (i) At least one institution that is financially sustainable after 5 years; (ii) the existence, in the central Government agencies, of a cadre of skilled professionals able to advocate and facilitate implementation of RE policies for commercialisation; (iii) CREIA enjoying the strong participation of the RE industry and the investment community.

Activities for Output 2	Responsibility
1.2.1 Draft TOR for a sub-contract *to support the establishment of a Renewable Energy Industries Association with an Investment Opportunity Facility;* organise bidding process and recruit sub-contractor (see Annex 3.1 for outline TOR).	SETC/PMO /DESA
1.2.2 Support the formation of the China Renewable Energy Industries Association (CREIA). *Provide core funding, to be phased out over 5 years, for the salaries of one Director and a support person. At start-up provide office equipment and operating funding for the first two years. Draft a five-year business plan. Membership funds and event fees will be expected to eventually provide operating funds.*	PMO/sub-contractor
1.2.3 Provide an international tour for the Director and 3 Board members of CREIA and 4 related personnel (from SETC, SEPA and concerned provinces) to visit relevant industry associations.	PMO

1.2.4 Set up an Investment Opportunity Facility within CREIA. *The facility should identify renewable energy investment opportunities in an effort to attract private, foreign and state financing and equity participation. Opportunities may be ranked according to location, technology, opportunity for return and so on. The listing will be placed on the renewable energy website. Information of this facility should be promoted widely in targeted business and investment media..*	Sub-contractor
1.2.5 Create a website for CREIA, and link it to related websites in the PMO, and in SEPA and CRED	sub-contractor
1.2.6 Widely advertise and promote the co-ordination, information and networking function of CREIA within China through newspapers, broadcast media and technical and business journals.	CREIA/sub-contractor
1.2.7 Identify a cadre of professionals in SETC, SEPA, SDPC (ERI) and provide formal in-house training for the professionals on project management and on other issues related to supporting the development of the RE sector.	sub-contractor

1.3 Output 3

Capacity developed to implement market-friendly institutional and financial approaches for the commercialisation of renewable energy systems.

Success Criteria

The success of this Output will be measured as follows: (i) A cadre of policy-makers and sector professionals at the central and provincial levels trained in estimating external costs of energy production, financial / economic profitability of projects and development of market-based instruments and market-based institutions; (ii) Up to 12 professionals conversant with best international practices for market-oriented utility management.

Activities for Output 3	Responsibility
1.3.1 Draft TOR for a sub-contract to *Build Capacities on Energy Externalities and Market Surveying*, organise bidding process and recruit sub-contractor (see Annex 3.2 for outline TOR).	SETC/PMO/DESA
1.3.2 Organise an International Utility Internship Program (IUIP). *Send up to 12 utility generation planning and design professionals on internship scholarships for 6 month periods with the appropriate departments of selected utilities utilising or planning to use renewables on the grid e.g. California, Philippines and India. Work programs shall be established with the utilities before the internees' departure.*	PMO
1.3.3 Based on findings of the ongoing (*wind concessions* and *geothermal energy*) and pipeline UNDP projects (*energy sector plan*), train professionals to estimate both external costs of energy production and conversion and financial/economic profitability of individual projects.	sub-contractor
1.3.4 Based on findings of the ongoing UNDP projects (*wind concessions* and *geothermal energy*) train policy decision-makers to evaluate the viability in China of market-based institutions for RE commercialisation, such as energy service companies.	sub-contractor
1.3.5 Based on findings of the ongoing *wind concessions* project and the pipeline *energy sector plan* project, design and prepare practical *pro forma* instruments useful in the commercialisation of renewable energy technologies such as standardised Power Purchase Agreements (PPA).	sub-contractor

1.3.6 Complete one study tour for 5 professionals on international experience with the use of economic instruments and market-based energy institutions.	PMO
1.3.7 Prepare and hold at least 6 regional seminars on market instruments for commercialising renewable energy and the estimation of energy externalities.	sub-contractor
1.3.8 In conjunction with 1.3.7 prepare and hold at least 6 regional seminars on market-based institutions such as Energy Service Companies (ESCO).	sub-contractor

1.4 Output 4:

Capacity developed for increased investment in Renewable Energy systems.

Success Criteria
The success of this project will be measured as follows: (i) A cadre of relevant entrepreneurs at the central and provincial levels trained in renewable energy investment assessment; (ii) At least 100 investment opportunities are identified and listed on the Investment Opportunity Facility (IOF) operated by CREIA.

Activities for Output 4	Responsibility
1.4.1 Draft TOR for a sub-contract to *Promote and advance investment in RE*, organise bidding process and recruit sub-contractor (see Annex 3.3 for outline TOR).	SETC/PMO/DESA
1.4.2 Based partly on outputs from the *wind concessions* and *energy sector plan* projects, design a workshop curriculum for training in business financing, establishment and operation of renewable energy technology companies and energy service companies.	sub-contractor
1.4.3 Present the workshop in at least 5 regions throughout China.	sub-contractor
1.4.4 Organise one renewable energy investment tour per year for 3 years to selected regions within China for teams of 10 potential investors.	sub-contractor
1.4.5 Identify available sources of capital for grant, equity and financing investment in renewable energy projects. *Investigate GOC, Banks, Bilateral and multilateral sources. Identify in particular opportunities that repatriation of Hong Kong may provide. Establish a data bank of investor profiles.*	sub-contractor
1.4.6 Organise and carry out annual, regional investment fora matching the data bank of available projects and opportunities with investors. *Use these fora for further transfer of information on overcoming investment barriers by for example providing information on the role of ESCO or performance insurance mechanisms.*	sub-contractor
1.4.7 In conjunction with national institutes such as CRED, provide a networking function by maintaining and managing the data bank of both investment opportunities and investors. *Use the website and user group to strengthen the network.*	sub-contractor

1.5 Output 5:

National capacity to assess renewable energy resource potential is developed.

Success Criteria
The success of this Output will be measured by: (i) A data base, with GIS capability, of at least 4 renewable energy sources is established (ii) a dynamic link is established between this database and the IOF operated by CREIA.

Activities for Output 5	Responsibility
1.5.1 Draft TOR for a sub-contract to *Prepare a resource inventory and GIS applications*, organise bidding process and recruit sub-contractor (see Annex 3.4 for outline TOR).	SETC/PMO/DESA
1.5.2 Identify sources of information extant with institutions throughout China and analyse data. *Search for data on the following resources: wind, solar, biomass, geothermal. Assess the data for their pertinence, temporal consistency and accuracy.*	sub-contractor
1.5.3 Identify and procure appropriate resource assessment portable field equipment such as devices to measure mass and moisture content of biomass, wind speed and insolation (much data should be available from the *wind concessions* project).	PMO
1.5.4 Identify personnel (in SETC, SEPA and ERI) and train them in renewable energy resource assessment. *In-house training should be given in data base requirements, data entry and manipulation, in methods of data extrapolation and in ground truthing techniques. Candidate project sites will be used to provide practical training.*	sub-contractor
1.5.5 Establish a national renewable energy database. *Enter data in standard D-base formats.*	sub-contractor
1.5.6 Identify personnel (in SETC, SEPA and ERI) and provide in-house training of personnel in GIS methods and interpretation.	sub-contractor
1.5.7 Apply GIS to the renewable energy database. *Where possible overlay pertinent GIS information showing infrastructure and population.*	sub-contractor
1.5.8 Identify a prioritised list of data gaps /issues. Identify equipment requirements and the research needed specifying the required inputs and institutional responsibilities.	sub-contractor
1.5.9 Within the available budget implement key recommendations of the data gap study by for example purchasing and installing monitoring equipment, or carrying out field research for correlation.	sub-contractor
1.5.10 In cooperation with CREIA, integrate the IOF database (Activity 1.2.4) with the resource database (Activity 1.5.5) .	SETC/PMO

1.6 Output 6:

Standards and codes of practice are established amongst the renewable energy industry.

Success Criteria

The success of this project will be measured as follows: (i) Standards and codes are widely available and conformed to within the RE industry; (ii) an identifiable set of national and provincial agencies able to carry out standards testing and validation.

Activities for Output 6	Responsibility
1.6.1 Draft TOR for a sub-contract to *develop standards and capacity to implement standards covering renewable energy technologies*, organise bidding process and recruit sub-contractor (see Annex 3.5 for outline TOR).	SETC/PMO/DESA

1.6.2 Review international experience for equipment standards, codes of practice and certification for selected renewable technology. *Five technologies will be assessed:* *Solar Hot Water,* *PV and wind hybrid systems for village applications,* *bagasse cogeneration systems,* *intermediate scale wind turbines, and* *industrial scale biogas systems.* *Standards are to be considered for the total system including Balance of System (BOS).*	sub-contractor
1.6.3 In cooperation with CREIA carry out a nation-wide consultation process with the renewable energy industry on standard setting for the selected systems and their components.	sub-contractor
1.6.4 With CREIA, research Institutes and other private sector industry representatives develop equipment and systems standards. Identify testing procedures required to meet compliance.	sub-contractor
1.6.5 With CREIA, research Institutes and other private sector industry representatives develop codes of practice for installation, commissioning and service / warranties	sub-contractor
1.6.6 With GOC assistance, identify and develop the capacity of a key number of national and provincial agencies able to carry out standards testing and validation.	sub-contractor
1.6.7 Codify Equipment and Systems standards, their testing procedures and codes of practice.	sub-contractor
1.6.8 In cooperation with CREIA promote the resulting document(s) as well as the registry of Testing Agencies widely throughout the industry.	sub-contractor

1.7 Output 7:
Certification capacity is established for solar water heaters.

Success Criteria
The success of this Output will be measured as follows: (i) Capacity of a GOC-selected National Certification Institute is built; (ii) Certification is widely endorsed and implemented by a majority of the industry.

Activities for Output 7	Responsibility
1.7.1 Draft TOR for a sub-contract to *develop certification procedures for solar hot water systems*, organise bidding process and recruit sub-contractor (see Annex 3.6 for outline TOR).	SETC/PMO/DESA
1.7.2 Identify a National Certification Institute for solar hot water panels and systems.	sub-contractor
1.7.3 Work with the certification institute to establish testing and certification procedures for solar hot water systems. Identify equipment testing requirements.	sub-contractor
1.7.4 Procure testing equipment.	sub-contractor
1.7.5 Advise the industry of certification procedures.	CREIA/sub-contractor
1.7.6 Advertise widely amongst the industry and the public the meaning of the certification stamp of approval.	CREIA/sub-contractor

2. Immediate Objective 2:

Barriers specific to four promising renewable energy technologies removed.

2.1 Output 1:

Removal of barriers to solar / wind hybrid electricity commercialisation.

Success Criteria

The success of this Output will be measured by: (i) 200 small scale PV/wind/battery/inverter units installed in households; (ii) 3 adjacent communities served by hybrid generation systems; (iii) the capacity of a regional institution to provide installation and maintenance service is strengthened; (iv) replication of solar/wind hybrid pilots can be observed.

Activities for Output 1	Responsibility
2.1.1 Draft TOR for a sub-contract to *assist the project to remove barriers to solar/wind hybrids*, organise bidding process and recruit sub-contractor (see Annex 3.7 for outline TOR).	SETC/PMO/DESA
2.1.2 Through the CREIA, organise training on strengthening the support services to the hybrid power systems and networking events for the solar/wind hybrid industrial sector. *Events will include: One international tour (8 people, 1 month), one in-China tour per year for 3 years, one annual industry conference for 3 years.*	PMO
2.1.3 Identify a pilot program region for a pilot household and 3 pilot village hybrid system sites.	PMO/sub-contractor
2.1.4 Negotiate regulatory and financial matters between local energy supply companies and customers.	sub-contractor
2.1.5 Procure, install and commission systems. *Where possible Chinese technology should be used providing it meets specified quality and performance standards.*	sub-contractor
2.1.6 Analyse the equipment and training requirements for an existing regional installation and service centre selected to serve the regional pilot equipment. Procure equipment and provide training on installation, servicing and maintenance of equipment.	sub-contractor
2.1.7 Prepare a report suitable for technical journals on implementation and one year performance of the pilots.	sub-contractor
2.1.8 Prepare recommendations suitable for policy-makers on analysis requirements and changes to implementation procedures to increase commercialisation of hybrid systems.	sub-contractor
2.1.9 With CREIA and an appropriate research institute (e.g. CRED) prepare a guidebook for investors in hybrid home and village systems and make it widely available electronically on the Net and in printed format.	sub-contractor
2.1.10 Organise study tours, seminars and workshops to observe the three village and the household sites amongst industry representatives.	sub-contractor

2.2 Output 2

Barriers to wind farm commercialisation removed.

Success Criteria

The success of this Output will be measured by: (i) the widespread acceptance and adoption of improved manufacturing and installation standards by the intermediate scale wind manufacturing industry; (ii) Wind farm Development Departments are established and sustained within 3 utilities; (iii) at least one utility is actively pursuing a windfarm project identified by the Project.

Activities for Output 2	Responsibility
2.2.1 Draft TOR for a sub-contract to *assist the project to remove barriers to windfarm energy*, organise bidding process and recruit sub-contractor (see Annex 3.8 for outline TOR).	SETC/PMO/DESA
2.2.2 In cooperation with the industry association CREIA work with intermediate scale wind turbine manufacturers to increase manufacturing standards to those set by the project. *Specifically: (i) Identify issues within the industry and assess technology standards; (ii) hold regional training seminars on technical standards improvements and international codes of practice (iii) provide one international tour for manufacturers / installers to encourage Joint Venture opportunities.*	sub-contractor
2.2.3 Fund the establishment of Wind Farm Development Departments within 3 selected utilities. *Utilities are to selected on the basis of their eagerness to participate, their contribution of personnel and resources to the Department and on their proximity to regions of a wind resource identified earlier within this project.*	sub-contractor
2.2.4 Organise an international tour of utility and industry personnel to selected utility and IPP operated sites (e.g. California, India, Denmark)	PMO
2.2.5 Seek IPP investors. *Use the established Renewable Energy Investor Network and the CREIA.*	sub-contractor
2.2.6 Communicate the results of the pre-investment analyses to other Utilities in China through an information brochure.	sub-contractor

2.3 Output 3

Barriers to large-scale anaerobic biogas commercialisation removed.

Success Criteria

The success of this Output will be measured by: (i) a generic design established for large scale biogas plants appropriate to the Chinese market; (ii) 3 pilot large-scale anaerobic biogas plants installed and monitored; (iii) a National institution is strengthened to provide technical services for biogas cogeneration; (iv) replication of anaerobic biogas digester designs can be observed.

Activities for Output 3	Responsibility
2.3.1 Draft TOR for a sub-contract to *assist the project to remove barriers to biogas energy*, organise bidding process and recruit sub-contractor (see Annex 3.9 for outline TOR).	SETC/PMO/DESA
2.3.2 Create a generic design for a large scale biogas plant suitable for the Chinese market.	sub-contractor
2.3.3 Organise and carry out regional seminars and study tours to existing and feasible biogas cogeneration sites.	sub-contractor
2.3.4 Identify 3 sites for pilot projects. Coordinate financing and legal arrangements with co-proponents. Assist in the preparation and negotiation of PPA with local utilities. *Tentative sites include: a distillery in Shandong province and two pig farms, one in Zhejiang Province, the other in the vicinity of Beijing. Criteria for site selection should include visibility of the demonstration and the willingness of the operator to participate financially.*	PMO/sub-contractor

2.3.5 Procure, manufacture/assemble biogas equipment.	PMO
2.3.6 Construct and install equipment at each site. Commission equipment.	sub-contractor
2.3.7 Publish and circulate the results of the biogas pilot. *Include the model design drawings and specifications; the results of monitoring and evaluation of the pilots both technically and financially.*	sub-contractor
2.3.8 In collaboration with CREIA, organise study tours, seminars and workshops to observe the three sites amongst industry representatives.	sub-contractor

2.4 Output 4

Barriers to bagasse cogeneration removed.

Success Criteria

Success of this Output will be measured by replication of the cogeneration system design observed in retrofit sugar facilities.

Activities for Output 4	Responsibility
2.4.1 Draft TOR for a sub-contract to *assist the project to remove barriers to bagasse cogeneration*, organise bidding process and recruit sub-contractor (see Annex 3.10 for outline TOR).	SETC/PMO/DESA
2.4.2 Establish and transfer best practices for power cogeneration through inter-provincial tours and workshops. Organise one international tour.	PMO/sub-contractor
2.4.3 Select two sites for pilot demonstrations of retrofit construction. *Selection criteria should include the willingness of the operator to participate financially and the willingness of the local utility to facilitate private power purchases.*	sub-contractor
2.4.4 Work with the operator to establish contractual arrangements for risk relief, performance contracting and financing. *Co-ordinate conditions for a PPA with the local utility.*	sub-contractor
2.4.5 Construct and install equipment on site.	sub-contractor
2.4.6 Report and transfer the results of the bagasse pilot to the sugar industry and utilities in the relevant provinces.	sub-contractor
2.4.7 Organise study tours, seminars and workshops to observe the two sites amongst industry representatives.	sub-contractor

2.5 Output 5

Barriers to local financing of RE projects are assessed and proposals for the removal submitted to Government

Success Criteria

Success of this Output will be measured by: a) at least $2 million is mobilized for credit to small power users without conventional access to financing b) repayment of loans will be above 90%.

Activities for Output 5	Responsibility
2.5.1 Draft TOR for a sub-contract to *assess the demand for and supply of credit for the purchase of renewable energy in the project areas*, organise bidding process and recruit sub-contractor (see Annex 3.11 for outline TOR).	SETC/PMO/DESA
2.5.2 Prepare brief paper outlining international experience with special funds for renewable energy	sub-contractor
2.5.3 Conduct survey of forms of credit available in the project areas.	sub-contractor
2.5.4 Conduct survey of demand for credit amongst potential users of renewable energy systems, particularly hybrid and biogas systems.	sub-contractor
2.5.5 Hold workshop on small credit for renewable energy.	PMO/sub-contractor
2.5.6 Present recommendations on small credit for renewable energy to Government in the form of a discussion paper, including, if appropriate, the establishment of a revolving fund.	PMO/sub-contractor

E.- INPUTS

1 Government and Other Domestic Inputs

1a) In-kind

a) Personnel (National Staff)
   i) Senior State representatives of SETC, SEPA and MOF to participate in the project Advisory Group.
   ii) Senior State representatives of SETC and SEPA to act as NPD and Deputy NPD.
   iii) Staff and support within related Energy Research Institutes and other Agencies as identified at the inception of the Project;
   iv) Specialists from GOC as required.
   v) Drivers and other support staff as required.

b) Training;
   i) facilities, in Beijing and the Provinces as required;
   ii) participant living expenses as required.

c) PMO accommodations, facilities and supplies. Office accommodation shall be provided Consultants on a temporary basis when they are in the locale.

d) Transport;
   i) internal transport for GOC participants to and from training / seminar events;
   ii) internal transport for PMO and other professionals on Project business as required.

1b) Financial

Expected sources of funds:	National Government	in-kind
	Beneficiary enterprises	$11.5 million

Most domestic financial support is in the form of technology supplied by enterprises or by the municipal Government. Details of this are listed below. Should the municipal governments/ enterprises not be able to provide the finance, the SETC shall cover these inputs in the form of a soft loan.

e) Equipment;

i) capital and operating costs of pilot project technologies when not provided by other domestic sources of capital;

ii) maintenance costs of equipment supplied under grant by the project;

iii) $11.5 million investment in technologies for pilot projects. The beneficiary enterprises are to pay the majority of the costs for purchasing new energy technologies, as follows:

- Hybrid solar, wind, battery, inverter, controller and grid distribution systems; estimated cost (for 200 household and 3 village systems) = $ 1.5 million. GOC contribution: $500,000
- Biogas cogeneration at 3 sites; estimated cost per site = $1 million; GOC contribution $2million
- Bagasse cogeneration at 2 sites; estimated cost per site = $5 million; GOC contribution $9million

UNDP/GEF will cover the remaining costs associated with obtaining this technology, in line with the incremental costs. UNDP/GEF contribution to this is detailed in Section h of UNDP inputs below.

2 GEF/UNDP and Bilateral Inputs

Expected Sources of funds:	GEF	$ 8.80 million
	Bilateral	$ 5.53 million
	Total	$14.33 million
Project Duration:	5 years	

ITEM			Total US $ 000
a) Personnel: Salaries, mobilization costs and benefits associated with:			**1,418**
	Int. (months)	Nat. (months)	
i) Sr. Technical Advisor	60		840
ii) National Coordinator		60	100
iii) UN Volunteers (2)	120		300
iv) Technical Specialists	5		90
v) CREIA Director		36	88
b) Mission Costs To support technical back-stopping missions by the UN Executing Agency			**20**
c) In-country travel			**920**
d) Subcontracts	Int p/m	Nat p/m	**2,234**
• Output 1.2: Set up CREIA, set up an IOF, capacity building	7	13	166
• Output 1.3: Capacity building for energy externalities, market surveys, pro forma development	8	24	208
• Output 1.4: Investment promotion and advancement for RE	7	29	198
• Output 1.5: Resources inventory and GIS application	6	35	240
• Output 1.6: Standards development for 4 technologies	19	51	482
• Output 1.7: Certification procedures for solar hot water systems	4	15	120
• Output 2.1: Hybrid systems design, servicing, installation and monitor	8	54	257
• Output 2.2: Windfarm promotion, design and measurement	5	15	151
• Output 2.3: Biogas design, project management and monitor for 3 sites	4	44	168
• Output 2.4: Bagasse design, project management and monitor for 2 sites	3	42	143
• Output 2.5: Assessment of credit situation in project area			100
e) Training - In country training; seminars, workshops, consultations at the regional and central levels - 88 events			**1,760**
f) Study Tours - International study tours; number of person-			**210**

months = 42	
g) Fellowships - Utility Internships - number of person-months = 60	**300**
h) Equipment - Grant Funded	**5,940**
• Computer and Office equipment and services	50
• Portable field monitoring for solar, wind and biomass	40
• Supplementary monitoring for solar and wind	501
• Solar simulator for hot water system certification	1,000
• Maintenance and installation and spare parts for solar and wind hybrid	300
• Monitoring equipment for hybrid systems;	50
• Wind data anemometers and data logging equipment for 9 locations	1,000
• Hybrid solar, wind, battery, inverter, controller and grid distribution systems; estimated total cost for 200 household and 3 village systems = $ 1.5 million. (GEF only covers the *Incremental* cost of this item. GOC covers the remainder as indicated in Section e) of GOC contribution above)	1,000
• Biogas cogeneration at 3 sites; estimated total cost per site = $1 million (GEF only covers the *Incremental* cost of this item. GOC covers the remainder as indicated in Section e) of GOC contribution above)	1,000
• Bagasse cogeneration at 2 sites; estimated total cost per site = $5 million (GEF only covers the *Incremental* cost of this item. GOC covers the remainder as indicated in Section e) of GOC contribution above)	1,000
i) Miscellaneous -	**400**
Communication, Reports, printing	260
Auditing	140
j) Support Costs	**1,128**
k) TOTAL	**14,330**

Further details on the Equipment requirements are provided in Annex 8.

3 UNDP Associated-financing

UNDP is to finance a project on *National Energy Strategy and Plan* (approx. $100,000) which is closely related to this project. Implementation is scheduled to begin in 1999.

Resources Concessions for Sustainable Development of Renewable Energy in China ($125,000) started in November 1997.

Geothermal Development to meet the Basic Needs of the Population of Nagqu Town in Tibet ($517,500) *started in August 1997*

In addition, *Modernized Biomass Energy in Jilin Province (*over $1 million) may begin in 1999.

F.- RISKS

Potential risks and estimated likelihood include the following:

Potential Risk	**Estimated Likelihood**
Pilot projects will not be able to proceed because the required external financing is not available.	Minimal: GOC has committed to supplement any shortfall in financing (SETC invests $15 million annually in soft-loans for RETs). In the case of Hybrids serving the rural poor, where financial profitability is poor even for conventional systems, grant support is proportionally higher than for the industrial applications of biogas and bagasse where financing can more readily be obtained. Moreover, a great deal of prior effort has gone into identifying willing local partners, and their support seems assured.
The implementing capacity of National Organisations has been overestimated or the responsibility for the implementation of multiple Outputs simultaneously becomes inefficient.	Moderate: A large responsibility will be placed on sub-contractors from the outset of the Project. At the inception care will be taken to effectively plan the sub-contracts. Their performance will be monitored by the PMO and the AG and adjustments made if required.
CREIA will not be economically sustainable after 5 years.	Moderate: The Project will help CREIA to develop its business plans for its first 5 years. It will further develop a membership and a client base to form the sustaining mechanism for the Association.
The regulatory and market investment measures promoted by the project will fail in attracting follow-up investment.	Minimal: The project will stress communication with the investment community. Management structure and the ongoing monitoring of the project will mean that a range of mechanisms can be assessed and tried in the Chinese context. This flexible trial and error approach means a greater likelihood of finding measures appropriate for China and enhanced opportunities for replication.
Investors and Manufacturers will not comply with the standards developed in the project/	Minimal. The process to preparing the standards will be participatory, involving representatives of investors and manufacturers. Hence investors and manufacturers will agree with the standards. In general it will be in the interest of the investors/manufacturer to comply, this will facilitate sales of their products. Also PPA and other agreements can stipulate the standards of technology used.

G.- PRIOR OBLIGATIONS AND PREREQUISITES

Prior Obligations

None.

Prerequisites

The Advisory Group and the Implementing Agency as outlined in Section B.4 have been established. GOC inputs have been clearly identified and scheduled.

The project document will be signed by UNDP and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled or are likely to fulfilled. When anticipated fulfilment of one or more prerequisites fails to materialise, UNDP may, at its discretion, either suspend or terminate its assistance.

H.- PROJECT REVIEWS, REPORTING AND EVALUATION

The project will be subject to tripartite review (TPR) by a representative of the Government, UNDP and UNDESA at lest once every twelve months from the start of full implementation. The TPR, chaired by SETC, will review progress in light of the project document, identify problems, if any, and decide on the corrective actions and responsibility of each party. The NPD shall prepare and submit to each TPR meeting a Project Performance Evaluation Report (PPER). Additional PPERs and or progress reports may be requested, if necessary, during the project. AG members will participate in the TPR. MOFTEC, as the focal point for AUSAID in China, will participate fully in the TPR.

The project shall be subjected to a mid-term evaluation in its third year of implementation. The evaluation will be organised by UNDESA and SETC and will jointly involve the UNDP and all donor agencies. The evaluation will look into the direction and effectiveness of implementation of the project, and will recommend to UNDP, GOC, the Advisory Group and MOFTEC any actions necessary to achieve project objectives or increase effectiveness. The terms of reference and timing of the review will be decided after consultation between the parties concerned. An evaluation report will be produced through this exercise.

The project shall be submitted to a final evaluation by independent evaluators. An evaluation report, and project terminal report, will be prepared and submitted to the final TPR. These shall be in draft form sufficiently far in advance so as to allow review and technical clearance by SETC and UNDESA.

The project shall be submitted to an annual external financial audit.

Additional internal project reporting is discussed in section B.4 and in Output 1.1

I.- LEGAL CONTEXT

The Project document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement (SBAA) between the Government of the People's Republic of China and the United Nations Development Programme, signed by the parties on 29 June 1979. The host country implementing agency shall, for the purpose of the SBAA, refer to the Government Cooperating Agency described in the agreement.

The following types of revisions may be made to this project document with the signature of the UNDP Resident Representative only, provided he or she is assured that the other signatories of the project document have no objection to the proposed changes:

1. revision in, or addition of, any of the annexes of the project document (with the exception of the Standard Legal Text for non SBAA countries which may not be altered and the agreement to which is a pre condition for UNDP assistance).
2. Revisions which do not involve changes in the immediate objectives, outputs or activities of a project, but are caused by rearrangements of inputs already agreed to or by cost increases due to inflation. and,
3. Mandatory annual revisions which rephase the delivery of agreed project inputs, or reflect increased expert or other costs due to inflation, or take into account agency flexibility.

J. BUDGETS

CAPACITY BUILDING FOR THE RAPID COMMERCIALIZATION OF RENEWABLE ENERGY IN CHINA
Project Budget Covering UNDP Contribution

Project Number:

Code	Description	Total		1998		1999		2000		2001		2002	
		p/m	000 $	p/m	000 $	p/m	000 $	p/m	000 $	p/m	000 $	p/m	000 $
10	PROJECT PERSONNEL												
11	International Professionals	60	840	12	168	12	168	12	168	12	168	12	168
	Senior Technical Advisor												
	UNV	120	300	24	60	24	60	24	60	24	60	24	60
	Technical Specialists	5	90	5	90	0	0	0	0	0	0	0	0
11-99	Subtotal	185	1230	41	318	36	228	36	228	36	228	36	228
15	Official Travel												
15-01	Duty Travel		920		184		184		184		184		184
15-99	Subtotal		920		184		184		184		184		184
16	Mission costs												
16-01	Mission costs		20		20								
16-99	Subtotal		20		20								
17	National Professionals												
	National Coordinator	60	100	12	20	12	20	12	20	12	20	12	20
	CREIA Director	36	88	12	25	10	25	8	20	4	9	4	9
17-99	Subtotal	96	188	24	45	22	45	20	40	16	29	16	29
19	COMPONENT TOTAL	281	2358	65	567	58	457	56	452	52	441	52	441
20	SUBCONTRACTS												
	CREIA, IOF	20	166	12	100	8	66						
	Externalities, mkts, pro form	32	208	16	104	16	104						
	Investment promotion	36	198			24	133	12	65				
	Inventory of data, GIS	41	240			14	79	27	161				
	Standard setting	70	482			35	241	35	241				
	Certification of Solar	19	120							6	40	13	80
	Credit	0	100				25		25		25		25
	Hybrids, design install	62	257	20	85	31	129	6	23	2	10	2	10
	Windfarm	20	151	6	50	10	75	2	14	1	6	1	6
	Biogas 3 sites	48	168	16	55	24	84	4	15	2	7	2	7
	Bagasse 2 sites	45	143	14	43	14	43	14	43	2	7	2	7
29	COMPONENT TOTAL	393	2233	84	437	176	979	100	587	13	95	20	135
30	TRAINING												
	In-Country events		1760		352		352		352		352		352
	Fellows		300				300						
	Study Tours		210				70		70		70		
39	COMPONENT TOTAL		2270		352		722		422		422		352

Project Number: Code		Description	Total p/m	000 $	1998 p/m	000 $	1999 p/m	000 $	2000 p/m	000 $	2001 p/m	000 $	2002 p/m	000 $
	40	EQUIPMENT												
		Computer / office		50		50								
		Field monitor		40				40						
		Data gap filling		501						167		167		167
		Solar simulator		1000								1000		
		Hybrid maint. & install		300				300						
		Hybrid PV wind grid & BOS		1000				1000						
		Hybrid monitor		50						50				
		Wind recording		1000				1000						
		Biogas Cogeneration 3 sites		1000				1000						
		Bagasse - 2 sites		1000				1000						
	49	COMPONENT TOTAL		5941		50		4340		217		1167		167
	50	MISCELLANEOUS												
51-01		Communication		65		13		13		13		13		13
52-01		Reporting		130		26		26		26		26		26
53-01		Sundry		65		13		13		13		13		13
54-01		Project Support Services		1128		220		227		227		227		227
55-01		Financial Auditing		140		28		28		28		28		28
	59	MISCELLANEOUS		1528		308		305		305		305		305
	99	BUDGET TOTAL		14330	149	1714	234	6803	156	1983	65	2430	72	1400

ANNEX 1: THE WORKPLAN

OBJECTIVE 1

Outputs 1.1 -- 1.5

No	Output / Activity	Year One				Year Two				Year Three				Year Four				Year Five			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.1	Sound basis for project																				
1.1.1	Set up office	----	----																		
1.1.2	Draft detailed workplan		----																		
1.1.3	Inception workshop		----																		
1.1.4	Draft 6 monthly wkplan		----		----		----		----		----		----		----		----		----		
1.1.5	Database of projects			----																	
1.1.6	Newsletter and website			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1.2	Strong focal point institns.																				
1.2.1	Draft TOR		----																		
1.2.2	Form CREIA			----																	
1.2.3	Study tour				----																
1.2.4	Set up investment facility (IOF)					----															
1.2.5	Create CREIA website						----														
1.2.6	Network and info exchange						--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1.2.7	Training in project m.ment								----												
1.3	Capacity for commercialis																				
1.3.1	Draft TOR			----																	
1.3.2	Organise IUIP				----																
1.3.3	Train professionals					----															
1.3.4	Train policy makers						----														
1.3.5	Design instruments, eg PPA							----													
1.3.6	Study tour							----													
1.3.7	Seminars on market instruments									--	--	--	--	--							
1.3.8	Seminars on institutions, eg ESCOs											--	--	--	--	--					
1.4	Capacity to promote investments																				
1.4.1	Draft TOR			----																	
1.4.2	Design workshop				----																
1.4.3	Workshops					----	----														
1.4.4	In—country tour						----	----													
1.4.5	Identify sources of finance								----												
1.4.6	Regional investment fora									----											
1.4.7	Networking										--	--	--	--	--	--					
1.5	Capacity to assess resources																				
1.5.1	Draft TOR				----																
1.5.2	Identify sources of info				----																
1.5.3	Procure equipment					----	----														
1.5.4	Identify personnel and train						----	----	----												
1.5.5	Establish database								----												
1.5.6	Identify personnel and train								----	----											
1.5.7	Apply GIS										----										
1.5.8	Identify data gaps and equipment needs											----									
1.5.9	Fill data gaps where possible											----	----								
1.5.10	Integrate two databases												----								

Objective 1
Outputs 1.6 -- 1.7

No	Output / Activity	Year One				Year Two				Year Three				Year Four				Year FIve			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.6	Standards and codes of practice																				
1.6.1	Draft TOR				----																
1.6.2	Review international experience				----																
1.6.3	Nation—wide consultation process					----															
1.6.4	Develop standards and identify procedures					----	----														
1.6.5	Develop codes of practice						----	----													
1.6.6	Develop testing capacity							----	----												
1.6.7	Codify standards								----												
1.6.8	Promote findings									--	--	--	--	--	--	--					
1.7	Solar Water Certification capacity																				
1.7.1	Draft TOR					----															
1.7.2	Identify national certification institute						----														
1.7.3	Establish certification procedures							----	----												
1.7.4	Procure equipment							----	----												
1.7.5	Advise industry								----	----	----	----									
1.7.6	Advertise widely the findings										--	--	--	--	--	--	--	--	--		

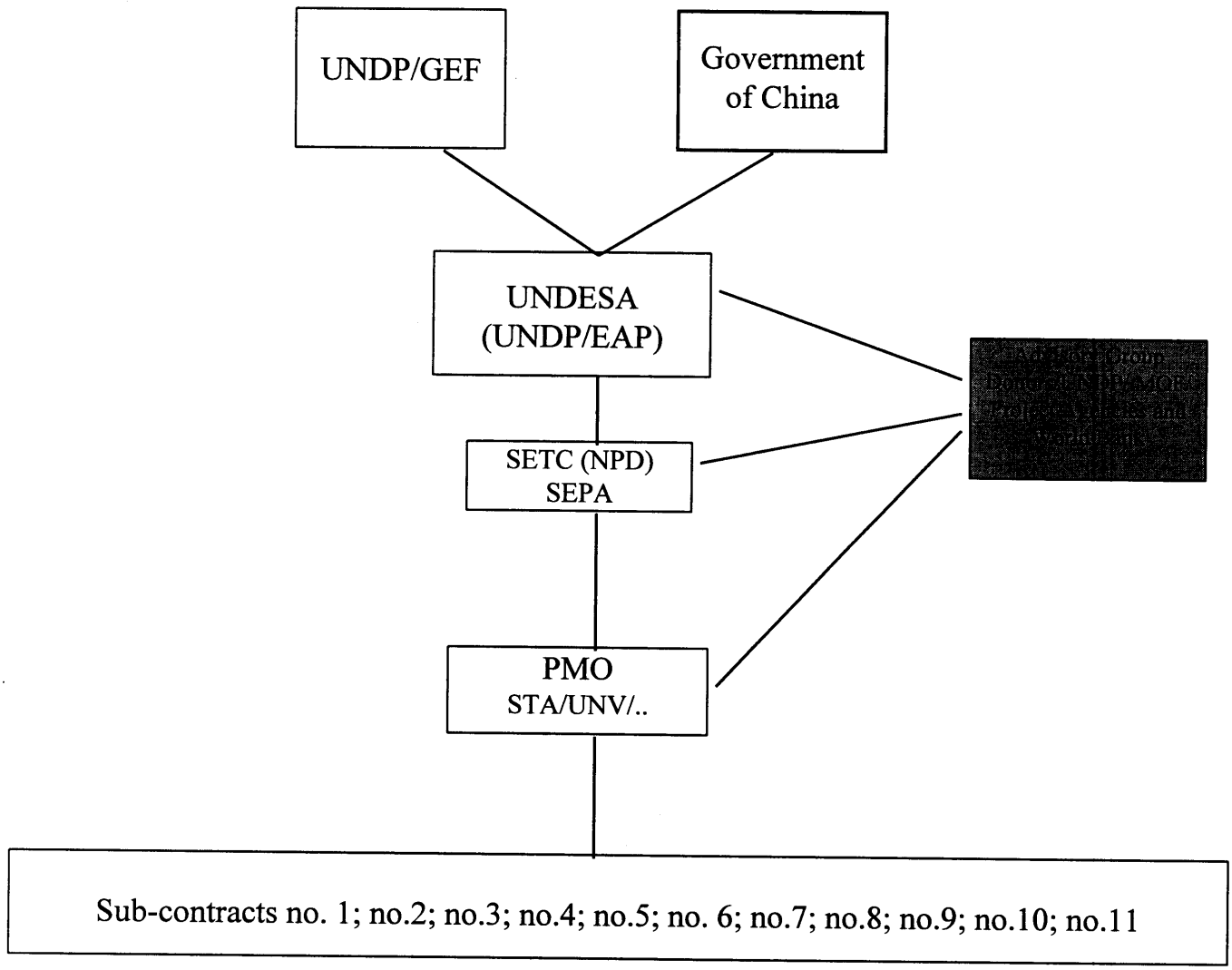
Objective 2
Outputs 2.1 -- 2.2

No	Output / Activity	Year One				Year Two				Year Three				Year Four				Year Five			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
2.1	Removal of solar/wind barrier																				
2.1.1	Draft TOR				----																
2.1..2	Training and networking					----	----														
2.1.3	Identify pilot programme					----	----														
2.1.4	Negotiate with local suppliers..						----	----													
2.1.5	Install systems						----	----	----												
2.1.6	Identify and undertake training									----											
2.1.7	Prepare technical performance report										----										
2.1.8	Prepare policy recommendations											----									
2.1.9	Prepare guidebook to investors											----	----								
2.1.10	In--country tour and workshop										--	--	--	--	--	--	--	--	--	--	--
2.2	Barriers to Wind farms removed																				
2.2.1	Draft TOR				----	----															
2.2.2	Increase manufacturing standards				----	----	----														
2.2.3	Establish wind departments						----														
2.2.4	International tour						----														
2.2.5	Seek IPP investors							--	--	--	--	--	--	--	--	--	--	--	--	--	--
2.2.6	Communicate findings							--	--	--	--	--	--	--	--	--	--	--	--	--	--

Objective 2
Outputs 2.3 -- 2.5

No	Output / Activity	Year One				Year Two				Year Three				Year Four				Year Five			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
2.3	Barriers to biogas removed																				
2.3.1	Draft TOR					----															
2.3.2	Design large--scale plant					----	----														
2.3.3	Regional seminars and tours						----	----	----												
2.3.4	Identify pilot sites						----														
2.3..5	Procure equipment							----	----	----											
2.3.6	Install equipment									----	----	----	----								
2.3.7	Circulate results															----					
2.3.8	Tours to the sites												----	----	----	----	----	----			
2.4	Barriers to bagasse removed																				
2.4.1	Draft TOR					----															
2.4.2	Establish best practices/study tour						----	----													
2.4.3	Select 2 pilot sites							----													
2.4.4	Establish contractual arrangements							----	----	----											
2.4.5	Install equipment								----	----	----										
2.4.6	Transfer results											----									
2.4.7	Study tours and seminars												----	----							
2.5	Financial barriers assessed																				
2.5.1	Draft TOR						----														
2.5.2	Prepare brief paper							----													
2.5.3	Conduct supply survey									----											
2.5.4	Conduct demand survey										----										
2.5.5	Hold workshop												----								
2.5.6	Present recommendations to Govt.														----						

ANNEX 2 CHART SHOWING PROJECT IMPLEMENTATION ARRANGEMENTS



ANNEX 3: OUTLINE TERMS OF REFERENCE FOR SUB-CONTRACTS

To assist in the administration and management of the Capacity Building, Project Outputs have been designed to be carried out as subcontracts under the supervision of the PMO. With the exception of Objective 1 - Output 1 each subsequent Output represents a discrete subcontract. The outline terms of reference for these are outlined on the following pages. During the project the PMO will develop detailed TOR before organising the bidding process.

Although they are described as discrete work segments the PMO and the UNDESA will be free to group the subcontracts into "packages" as they see fit. Packaging of subcontracts would allow for one contractor to build up experience and to develop continuity with the Project. Care would be required to ensure the selected contractor could provide the full range of services required in the packaged subcontracts.

UNDESA will issue Requests for Proposals and will negotiate all subcontracts. Subcontracts may be with national or international firms and agencies and with joint ventures among them. In the case of joint submissions lines of authority will be clearly shown to facilitate administration of the contract and accountability for deliverables. UNDP/EAP will participate in the selection of sub-contractors.

All progress reports will be prepared in English in accordance with UNDESA guidelines for report preparation. Progress reports should be endorsed by the PMO and submitted to UNDESA in three copies without binding. UNDESA's comments on progress reports, if any, will be forwarded to the subcontractor who should either amend the report or annex them to the report before distribution.

The **Level of Effort** shown for each subcontract indicates budgeted amounts for consultant services and includes fees, travel, communication, report preparation and daily living allowances. It does not include equipment or training costs.

Outline TOR for Subcontract 1: Establishment of a Renewable Energy Industries Association with an Investment Opportunity Facility

Output 1.2

Tasks:

1. Organise and provide training on project management skills. Skills should include budgeting procedures, monitoring, contract design and negotiation, scheduling and performance evaluation. Training should take place within the first year.

2. Provide consulting services for the creation and institutional establishment of the China Renewable Energy Industries Association (CREIA). Work with the PMO and other Chinese agencies to establish a Board of Directors, bylaws and operation systems. Develop a 5-year strategy for a business plan and assist in its development.

3. Create linked websites for the Project incorporating the technical, commercial and promotional outputs that are to be expected. Site requirements include: activities of CREIA, an Investment Opportunity Facility, information on renewable resources and so on.

4. Assist CREIA to establish an Investment Opportunity Facility in which potential renewable energy projects are identified and elaborated. Information must be relevant to commercial investors. A database format will first be established and approved by the PMO, CREIA and CRED. Second the data base will be created using information from available secondary sources with State and Provincial agencies;

Level of Effort

$166,000

Required Qualifications:

Senior (at least 10 years) business and financial planning skills;
Knowledge of Chinese corporate law;
Project management skills;
Computer networking and Internet skills;
Training and research skills.

Outline TOR for Subcontract 2: Capacity Building for energy externalities and market surveys

Output 1.3

Tasks:

1. Design, organise and provide a training program for professionals on renewable energy project appraisal. To the extent possible training should be focused on examples of RE projects existing in China. Review current literature and carry out primary research where required. Skills should be provided in project identification (general technology design and costing parameters and economic / financial viability appraisal), in appraising RE projects against alternatives and in project preparation. Emphasis should be placed on the estimation and incorporation of regional external costs of energy production and conversion when evaluating against alternatives. Although environmental externalities are of first importance other socio-economic factors should also be considered. Training needs should be identified at the inception and phased in appropriate segments to provide introductory and advanced skill levels for both State and Provincial Agencies. Each course program will be for about 30 people varying from 2 to 5 days. Two State programs and 5 regional provincial programs shall be provided.;

2. Identify relevant market-based instruments and institutions (such as Independent Power Producers, Energy Service Companies and so on) important in accelerating the commercialisation of renewable technologies. Draw on international best practicesand recent developments in China as sources of information. Identify issues and barriers important to the Chinese context. To the extent possible address these issues by preparing or adapting pro forma material such as PPA.

3. Design and carry out 2 State level and 6 regional provincial level training programs on market-based instruments and institutions for Chinese RE professionals, the investment community, utilities, community organisations and other relevant organisations. In conjunction with the programs develop training materials for distribution.

Level of Effort

$208,000

Required Qualifications

Senior (at least 10 years) international energy economics capability current with RE appraisal and the estimation of energy externalities both environmental and socio-economic;
International financial and legal capability familiar with emerging market-based mechanisms for private energy production and sales. At least 5 years of experience;
Training materials preparation, teaching and group facilitation expertise.

Outline TOR for Subcontract 3: Investment Promotion and advancement of RE

(Output 1.4)

Tasks:

1. Work with CREIA to identify the needs and issues of RE entrepreneurs and the investment community in identifying sources of and arranging for debt, equity and concessionary financing.

2. Design and carry out in 5 regions training programs for entrepreneurs and investors in RE. Topics should include corporate establishment and operation, business planning and financial investment and environmental assessment. New opportunities for private energy providers should be presented.

3. Assist CREIA to research, establish and maintain a database of capital sources for RE projects;

4. In cooperation with CREIA promote, organise and carry out in 5 Regions a series of annual Investment Fora over 3 years to highlight RE investment opportunities for investors, energy purchasers and RE entrepreneurs.

Level of Effort

$198,000

Required Qualifications

Strong linkages to the Chinese and international investment community;
Strong linkages to the Chinese RE community;
Experience with business planning and investment;
Extensive knowledge of energy private power financing mechanisms with at least 5 years experience;
Training and facilitation experience.

Outline TOR for Sub-contract 4: Resource Inventory and GIS Application

Output 1.5

Tasks:

1. Identify and assemble existing information on RE resources for wind, solar, biomass and geothermal.
2. Design a format for a resource database and enter data.
3. Enter other relevant available data such as existing energy infrastructure and location of energy demand;
4. Identify data gaps and recommend a program of monitoring equipment specification, procurement and installation;
5. Apply GIS to the database;
6. Provide training on RE resource monitoring, data requirement specification, data management and the use of GIS for data interpretation.

Level of Effort

$240,000

Required Qualifications

Knowledge of resource data requirements for solar, wind, geothermal and biomass technologies. Senior consulting capability with at least 10 years experience;
Knowledge of database creation and management techniques with at least 5 years experience;
Familiarity with regional sources of information on resource data in China;
Research and data entry capability;
At least 5 years of GIS experience.

Outline TOR for Subcontract 5: Standards Development for 5 Technologies
Output 1.6

The purpose of the standard setting exercise is to codify standards of performance and quality of materials to provide the RE industry a benchmark from which to promote its products. These procedures will be less onerous than a certification procedure but will require a high degree of industry compliance to be successful.

The sub-contractor will perform the following tasks under the guidance of a national standards committee (representatives from CRED, CREIA and other government agencies):

1. Review international experience for equipment standards, codes of practice and testing procedures for the following technologies: solar hot water, PV and wind hybrid systems for village applications, bagasse cogeneration systems, intermediate scale wind turbines and industrial scale biogas systems. From this review compile frameworks for standard setting in China for each of the technologies;

2. Review these frameworks nation wide. Canvass technology suppliers, researchers, designers, utilities, manufacturers and industrial associations to determine issues around and requirements for strengthening component and system standards. Use the process to establish requirements of compliance using voluntary industry mechanisms where possible. Compile the results of this survey in a revised and recommended framework;

3. Develop equipment and systems standards as appropriate for each technology within the recommended framework. Identify testing procedures and test equipment requirements in each case. Review drafts with industry representatives. Codify a final Standards Manual for each technology that has full agreement of industry;

4. For each technology and in co-ordination with the national standards committee identify national and/or regional testing centres for applying standards. It is likely that provincial Energy Research Institutes will be prime candidates for this role. Assess the capability of each ERI to provide complete standards testing with their equipment. Specify equipment upgrades in selected agencies to provide requisite testing in an efficient manner. Select testing centres appropriate to the geographic distribution of the resource, for example, Solar DHW equipment will require wide regional access to testing facilities in the Northern provinces; on the other hand wind turbine testing should take place in proximity to the resource but will not require a large number of testing agencies. Create formal agreements with Agencies to provide testing at the required standard.

5. Recommend a promotion plan identifying target audience and communication methods for ensuring wide application of the Standards.

6. **Estimated Level of Effort**

$482,000

Required Qualifications

Senior international engineering capability with at least 10 years of experience in design and commissioning in the following technologies;

- solar hot water;
- PV / diesel hybrid systems;
- wind / diesel hybrid systems;
- bagasse cogeneration systems;
- medium scale wind systems grid connected;
- biogas cogeneration systems.

Strong linkages to the Chinese RE research and manufacturing communities;

Outline TOR for Subcontract 6: Certification Procedures for Solar Hot Water Systems

Output 1.7

Tasks (in cooperation with a GOC-selected certification institute:)

1. Identify and codify testing procedures and equipment requirements for the certification of solar hot water panels and systems. Establish the testing and qualification procedure for all existing manufacturers;

2. Procure and supervise installation of testing equipment;

3. Communicate with solar hot water manufacturers to confirm compliance with certification procedures. Co-ordinate with these manufacturers to ensure they have had the opportunity to certify before public advertisement;

4. Recommend a promotion campaign amongst the general public to advise them of the meaning of certification;

Level of Effort

$120,000

Required Qualifications

Senior engineering capability with at least 10 years of experience in the design, testing and commissioning of solar hot water systems;
Experience in consumer product certification procedures;
Strong linkages to the Chinese solar hot water manufacturing community;

Outline TOR for Subcontract 7: Design, Installation, Servicing and Monitoring of Hybrid systems

Output 2.1

Tasks:

1. Carry out a best-practices study of international experience in off-grid PV and wind hybrid systems. Specify technologies and alternate institutional and financing mechanisms.

2. For a pilot region identify and evaluate options for about 200 household hybrid systems and 3 village hybrid systems (optimally where distribution grid already exists). Options should specify prefeasibility-level designs and costs, financing and administrative arrangements as well as required regulatory arrangements. The household site will accommodate about 200 small scale PV/wind/battery/inverter units to be installed in households. Within the region will be 3 adjacent communities to be served by hybrid (PV/wind/diesel) generation system. These communities will preferably have a 240/480 V distribution service network in place. Household systems should not likely exceed 50W(P) for PV and 200W for wind. Village systems should be designed for a range of system capacities but would likely not exceed 50kW(P) for PV and 50 kW for wind.

3. On approval complete design drawings and specifications for all systems. At this stage design for technical demonstration is a priority over financial viability. Systems, however, should be designed to meet national economic profitability criteria. Environmental impacts should be assessed and accounted for in the design.

4. Analyse the equipment and training requirements for an existing regional installation and service centre selected to serve the regional pilot equipment. Procure equipment and provide training on installation, servicing and maintenance of equipment.

5. Negotiate regulatory and financial matters between local energy companies and customers.

6. In conjunction with energy service providers procure specified hybrid energy equipment.

7. Design and implement a one year monitoring program of the systems' administrative, financial and technical performance. Report.

8. Prepare a guidebook for investors.

Level of Effort

$257,000

Required Qualifications

Senior international and national engineering capability in the design, procurement, installation and servicing of solar and wind hybrid systems;
Financial and legal experience with village and household level market based institutions for remote power applications;

Outline TOR for Subcontract 8: Promotion, design and measurement of windfarms

Output 2.2

Tasks:

1. Assess international best practices for wind farm / grid integration. Assessment should include resource data base development, site selection criteria, planning, design and grid-connection technical issues, O&M, and financial issues to do with ownership and PPA.

2. Work within 3 selected utilities to help establish and train Wind Farm Development Departments. Work within the Departments setting workplans and training programs enabling them prepare sites to pre-commercialisation levels. Train personnel by taking selected sites to pre-investment levels of preparedness. Procedures will include: Site identification, screening and characterisation, preliminary design of wind turbine and BOS, costing and prefeasibility analysis, environmental assessment, draft PPA preparation, preliminary financial assessment.

3. Procure and install wind recording equipment in three potential wind generation locations at each utility site. Provide training on data recording and equipment maintenance.

Level of Effort

$150,000

Required Qualifications

International experience with windfarm technical, administrative, financial and legal requirements;
Wind monitoring experience;
Training and facilitation experience.

Outline TOR for Subcontract 9: Design, management and monitoring of 3 Biogas co-generation plants

Output 2.3

Tasks:

1. Survey the Chinese market for potential biogas electricity generation opportunities and the international market for technical best practices. This will entail a survey of international best practices, the Chinese market of large-scale biogas feedstock (distillery waste, pig waste and so on), manufacturing and materials capability and experience. Report.

2. In cooperation with a biogas technical agency create a generic design for large-scale biogas plant/ generation system suitable for the Chinese market. The design will be to international standards but be cost-competitive and market-appropriate. Environmental impacts should be assessed and accounted for in the design. Incorporate the standards setting work carried out by the project.

3. Prepare equipment and construction specifications and drawings for each of 3 sites of moderate capacity.

4. Coordinate financing and legal arrangements with co-proponents and assist in negotiation with PPA.

5. Assist in equipment procurement.

6. Supervise equipment installation.

7. Monitor financial and technical performance over one year of operation. Report.

Level of Effort

$168,000

Required Qualifications

Senior international engineering with at least 10 years of experience in the design, specification and installation of industrial biogas systems;
Senior engineering with at least 10 years experience in design and specification of electricity generation technology with low BTU methane gas;
Project monitoring experience.

Outline TOR for Subcontract 10: Design, management and monitoring of 2 Bagasse cogeneration plants

Output 2.4

Tasks:

1. Survey the Chinese sugar industry to determine production capacities, volumes, existing cogeneration facilities and other market information.

2. Develop design specifications for optimised steam and power cogeneration under high pressure for retrofit construction in the Chinese sugar industry. Design to international best practices for high pressure boilers and steam turbines. Design considerations should encompass Chinese bagasse production volumes. It should be financially feasible for retrofit construction. Environmental impacts should be considered and appropriately accounted for.

3. Design and specify equipment for 2 selected sites.

4. Assist an energy agency to establish contractual arrangements for sale of power, risk relief, financing security and performance contracting.

5. Assist in the procurement of equipment.

6. Supervise installation and commissioning of equipment.

7. Monitor technical and financial performance for one year. Report.

Level of Effort

$143,000

Required Qualifications

Senior (at least 10 years) international engineering experience in the design, specification and installation of bagasse cogeneration equipment;
Experience with legal, financial and regulatory requirements for PPA;

Outline TOR for Subcontract 11: Assess credit barriers to local financing of RE projects

Barriers to local financing of RE projects are assessed and proposals for their removal are submitted to Government (Output 2.5)

The sub-contractor will assess the existing supply of and demand for credit to purchase renewable energy technologies. The assessment will focus on solar/wind hybrid and biogas systems. Based on international experience, and on the existing local situation, the sub-contractor will prepare recommendations to government for new financial schemes to assist potential buyers of renewable energy technologies.

Tasks:

1. Prepare brief paper outlining international experience with special funds for renewable energy;

2. Conduct survey of existing forms of credit available in the project areas;

3. Conduct survey of demand for credit amongst potential users of renewable energy systems, particularly hybrid and biogas systems.

4. Working with the PMO, organise and participate in a workshop on small credit for renewable energy technology;

5. Assist the PMO in the preparations of detailed recommendations to Government regarding small credit for renewable energy. The recommendations shall be in the form of a discussion paper. It is possible that the recommendations will cover the establishment of a revolving fund - in such a case the recommendations should cover the size, management structure and sources of capital for such a fund.

Level of Effort

$100,000

Required Expertise

Financing and money management experience with Chinese banking institutions;
Experience in local credit for energy systems in other countries
Familiarity with credit systems in China.

ANNEX 4: TORS FOR NATIONAL PROFESSIONALS

TOR for National Project Director

The Government shall appoint a National Project Director (NPD) to be responsible, on behalf of the government, for the project. It is likely that the NPD will be a senior official from the implementing agency. The NPD will work closely with the UN Executing Agency and the Project Management Office (in particular the Senior Technical Advisor). The NPD will be responsible for:

- Assuring the Government inputs to the project are forthcoming in a timely and effective manner;
- Assuring the project stays in line with national programmes, strategies and objectives;
- Overseeing the project implementation, and the timely undertaking of all activities.

In close coordination with the Senior Technical Advisor, the NPD shall:

1. Oversee the establishment of the Project Management Office with systems put in place for sound management of all project subcontracts and financial disbursements;
2. Prepare detailed draft workplan and inception report for both Objectives 1 and 2.
3. Contribute to identifying resource requirements, responsibilities, task outlines, performance evaluation criteria and workplans/ schedules.
4. Comment upon and approve detailed TOR and qualifications for each subcontract.
5. Support the establishment of project administration procedures for all staff, subcontractors and participating agencies.
6. Prepare quarterly status and financial reports for comment and approval of the Project Advisory Group;
7. Prepare 6 month budget forecast requests for approval of the Project Advisory Group;
8. Oversee the implementation of Project Advisory Group directives;
9. Coordinate the procurement of all equipment through UNDESA.
10. Help administer, through DESA, terms of reference for all subcontracts.

11. Monitor and evaluate subcontractor technical performance.

12. Oversee all evaluation and monitoring missions/activities.

TOR for CREIA Director

The CREIA Director will work closely with the Project Management Office and relevant national and international consultants. He/she should:

1. Support the establishment of CREIA and selection of CREIA staff.
2. Assume leading responsibility of the operation of CREIA and oversee performance of CREIA's staff
3. Take the lead in preparation of five-year business plan of CREIA
4. Be responsible for overall arrangements of relevant project activities conducted for CREIA, such as the establishment of Investment Opportunity Facility, setting up of website in CREIA, cooperation with enterprises and private sectors, etc.
5. Prepare status reports of CREIA's operation to the NPD and the Project Management Office.
6. Support dissemination of information on CREIA to relevant agencies at central/local levels and world wide
7. Prepare periodical financial reports to the PMO and UNDESA on expenditure of operating funding provided by the project for the first two year
8. Take the lead in mobilising financial resources for CREIA to function on a self-sustained basis

ANNEX 5: JOB DESCRIPTIONS FOR INTERNATIONAL EXPERTS

Post Title:	**Senior Technical Advisor**
Duration:	5 years
Qualifications:	• Post graduate degree in energy economics or engineering discipline; • 10 years of project management experience; • 15 years experience working on energy technology and development issues preferably in a developing country context; • Demonstrated understanding of technical, legal, institutional and financial issues and options for a range of renewable energy technologies; • Demonstrated experience in working with investors in RE technologies; • Excellent interpersonal skills; • China experience an asset.
Language:	English , Mandarin an asset

Duties:

Working closely with the National Project Director, the Senior Technical Advisor shall:

1. Establish a Project Management Office with systems put in place for sound management of all project subcontracts and financial disbursements;

2. Prepare a detailed draft workplan and inception report for both Objective 1 and 2. Identify resource requirements, responsibilities, task outlines, performance evaluation criteria and workplans/ schedules.

3. Create detailed TOR and qualifications for each subcontract.

4. Establish Project administration procedures for all staff, subcontractors and participating agencies. Publish procedures.

5. Prepare quarterly status and financial reports for comment and approval of the Project Advisory Group;

6. Prepare 6 month budget forecast requests for approval of the Project Advisory Group;

7. Implement Project Advisory Group directives;

8. Supervise the specification of all equipment requirements and coordinate procurement through UNDESA.

9. Develop and administer through DESA terms of reference for all subcontracts.

10. Monitor and evaluate subcontractor technical performance. Coordinate with UNDESA to ensure accountability for the quality of all subcontracts;

Post Title:	**UN Volunteer (1) - CREIA Liaison**
Duration:	5 years
Qualifications:	• University graduate in Business, Finance or International Development; • Experience in promotion, training, and communication; • Good interpersonal skills
Language:	English, Mandarin an asset

Duties:

Working within the CREIA as a liaison with the PMO.

To assist in the establishment of CREIA developing annual work programs and helping to implement same;

Establish and maintain links with the RE industry and with potential sources of investment using print and electronic media as well as scheduled events, training sessions and so on;

To assist in organising national and international tours on behalf of CREIA;

Post Title:	**UN Volunteer (2) - Liaison with national sub-contractors involved in outputs 1.2 to 1.7**
Duration:	5 years
Qualifications:	• University graduate in Engineering, Environment or Economics; • Experience with a range of renewable energy technologies; • Good interpersonal skills
Language:	English, Mandarin an asset

Duties:

Act as a liaison with the PMO and the sub-contractor (possibly located in the offices of the sub-contractor);

To assist sub-contractors in developing annual work programs and helping to implement same;

Establish and maintain links with the RE industry and research communities using print and electronic media as well as scheduled events, training sessions and so on;

To help set up training sessions;

To assist in organising national and international tours which integrate with activities implemented by the sub-contractor;

Post Title:	**Experts in solar thermal, PV, wind, biogas, bagasse, and private power mechanisms**
Duration:	1 person month each for 5 experts
Qualifications:	• Senior engineering design and commissioning experience; • Experience with private power system applications. Familiarity with legal, technical and financial issues; • Sound project management experience; • Project team experience;
Language:	English

Duties:

Travel to Beijing to work with the Senior Technical Advisor and the PMO to prepare an inception report at Project commencement. The report should include a budgeting of all resources, and specification of equipment to be purchased by the Project. In addition it will identify resource requirements, responsibilities, task outlines, performance evaluation criteria and workplans/ schedules. Further the Report will create outlines of terms of reference and qualifications for each subcontract.

ANNEX 6: RATIONALE FOR PILOT TECHNOLOGY SELECTION

The project will begin the process of removing barriers to the dissemination of five promising renewable energy technologies, namely (i) rural electrification by solar and wind hybrids; (ii) wind farm development; (iii) biogas prodction; (iv) bagasse cogeneration; and solar-water heaters. The selection of technologies has been made in consultation with the Chinese authorities and collaboration with the World Bank on the basis of recently undertaken assessments of market conditions and potential for future GHG reductions.

Three of the five technologies selected (windfarm, biogas, bagasse) represent renewable power applications for on-grid generation of power. This emphasis reflects the better understanding from the experience of other countries of the market and policy conditions necessary for a rapid commercialisation of these applications. They also pose the most significant potential reductions in GHG emissions. However, the fourth technology-- solar and wind hybrids-- represents a relatively new undertaking into the provision of electricity services to people living in areas where the electricity grid is not accessible. While a number of barriers remain in the widespread expansion of this technology to rural China, it has considerable promise to meet the electricity needs at small and medium rural load conditions with little or no GHG emissions. The fifth technology, solar water heaters, is already being disseminated through market mechanisms, but has encountered a barrier in the form of inconsistent product quality. The project activity for this technology will focus only on the development of standards and certification procedures.

a) Solar and Wind Hybrid Systems

It is estimated that nearly 70 million Chinese do not have access to the electricity grid. Many of those that do have access to the grid cannot obtain electricity from that grid due to power shortages. Hybrid technologies making use of solar, wind, and in some cases, diesel generators hold the potential to help provide power to this large group of people. While estimates of the potential for electricity generation through hybrid technology cannot be calculated accurately, it is clear that they will provide a key element in meeting the electricity needs of China's rural population over the long term. The hybrid power technology component builds on existing Chinese expertise to establish the in-country capacity to bring high-quality reliable renewable energy-based hybrid power technologies to the Chinese market for off-grid electricity services.

A handful of household, (using combined PV / wind generation and battery storage), and one village system (using wind/PV and diesel grid) is currently in place. Success has been mixed due to design and quality problems with the balance of systems. The World Bank project is being designed to finance and assist PV home systems but not hybrid systems. The pilot projects have been selected for these reasons.

b) Windfarms

While the definition of optional sites for windfarms is still rudimentary, it is estimated that windfarm development has a short-term potential of 1000 MW and a long term potential resources of up to 255 GW . The barriers to realising this potential are: (i) A lack of experience on windfarm performance and electric grid

interaction parameters; (ii) Low quality of intermediate-scale wind turbines; (iii) The limited demonstration of the financial and economic viability of wind farms in China; (iv) An inadequate policy environment for investment in wind farms, notably the lack of a standard independent power purchase agreement (PPA) and supporting regulatory framework; (v) the cost of advanced wind-farm components in China; and (vi) the limited availability of wind resource data suitable for wind farm project identification.

The pilot work with utilities provided by the project is important in laying the groundwork for later World Bank / GEF financing of windfarm installations. This project is designed to: (i) help utilities evaluate the international best practices for site selection, planning, O&M and electricity utility grid integration; (ii) develop standards for intermediate wind turbines; (iii) develop the capacity for wind farm site identification, screening and characterisation; (iv) conduct pre-feasibility assessments for several of the leading sites (v) collect site specific wind resource data over an extended period to bring down the cost of commissioning wind-farms; and (v) identify optimal power-sector development plans which will enable the Chinese electric grids to incorporate an intermittent power source like wind.

c) *Anaerobic Biogas Production*

Current estimates place the fraction of liquid organic waste from agricultural and industrial process that are processed in anaerobic digestors at less than 10% of the potential. If all of this waste from medium to large pig farms were captured, this would result in the capture of roughly 600 Mm3 per year of methane, enough to fuel roughly 100 MW of power. If the distilleries and other industrial entities processed their wastes in biogas digestors, this would account for another 900 Mm3 of methane annually--approximately another 150 MW. Despite China's positive experience with small-scale biogas, its utilization of larger-scale biogas digestors in the agricultural and industrial sectors is limited, attributable to the existence of a number of barriers to development. The major barriers at the project level preventing anaerobic digestion applications from reaching economic and financial viability are a complex mix of technical, policy and financial issues, including: (i) lack of standardization of the design and construction of large-scale anaerobic digestion systems; (ii) inappropriate separation, control and handling equipment; (iii) limited application of knowledge gained from the operation of existing plants in the design of future plants and poor acquaintance with international best practices; (iv) low financial returns for small-size biogas systems; and (v) policies creating few, if any, incentives to increase biogas production.

Government policy encourages the treatment of waste largely because of the removal of BOD from effluent. Few demonstrations of economic electricity generation from biogas are in place but these have been successful for the reduction in treatment costs alone. The World Bank / GEF project is not planning to finance biogas projects so the demonstration of the technology in the current project is important.

d) Bagasse Cogeneration

The production of cane sugar is a major economic activity in China. While 7 provinces are involved in sugar production, the majority of the cane sugar production is focused in the three (3) provinces of Guangxi,

Guangdong, and Yunnan. There is a major sugar industry expansion program underway to increase sugar production to 10 million tons per year from 650,000 hectares of cane by the year 2000, up from the 6.2 million tons produced in the 1994/95 crop year from about 420,000 hectares of cane. Although the estimates are fraught with complications, one estimate of the total national surplus power potential from the sugar industry has been placed at between 688 MW and 870 MW. Using new higher pressure and temperature equipment, the expected investment requirements in the higher efficiency systems can be estimated to be Yuan 6,640 per kW installed (U.S.$800 per kW installed).

The GOC is committed to expanding and retrofitting its sugar industry. Demonstration of the viability of bagasse cogeneration therefore comes at a strategically important time for utilisation of the renewable resource. The World Bank / GEF investments will not be supporting this technology so that support from this project is important.

e) Solar Water Heaters

The operation of solar water heaters is conceptually simple to understand: the sun's rays heat water in a collector which is then stored in a tank. However, experience in many countries has shown that low quality components can have a detrimental impact not only on the savings which can be achieved from these systems but also on the willingness of consumers to invest in such systems. North American and European standards went through a large number of revisions in a relatively short period of time prior to fixing on a solution providing high quality at an affordable price. For countries like China, there is much which can be learned from these iterative processes.

The solar water heater industry in China has already begun to experience problems attributable to inconsistencies in product quality. While many of the conditions for successful technological dissemination are met, the market has no way to assure uniform product quality.

ANNEX 7: TOR FOR ENERGY AND ATMOSPHERE PROGRAM TO SUPPORT PROJECT EXECUTION

In view of the expertise of the Energy and Atmosphere Pogramme (EAP) in the Sustainable Energy and Environment Division in UNDP office in New York on renewable energy, EAP will support UNDESA (the executing agency) on technical issues during project implementation.

Scope
With reference to Section J, *'Budget'* of this project document, EAP support will cover the following inputs/activities:

- BL 11.00 International Professionals (6 items):
  Senior Technical Advisor; the five Technical Specialists.

- BL 20.00 Subcontracts (11 items):
  CREIA; Externalities, Markets; Investment Promotion; Inventory of Data, GIS;
  Standard Setting; Certification of Solar; Credit; Hybrids, Design/Installation;
  Windfarm; Biogas 3 sites; Bagasse 2 sites.

- BL 40.00 Equipment (9 items):
  Field monitoring; Data Gap Filling; Solar Simulator; Hybrid Maintenance and Installation;
  Hybrid PV wind Grid and BOS; hybrid monitoring; Wind Recording; Biogas Cogeneration 3 Sites;
  Bagasse 2 Sites.

Content
EAP will provide the following assistance to UNDESA:

1. Provide comments on draft TORs for international consultants, subcontracts and draft specifications for equipment;

2. Provide assistance in identifying potential candidates for international consultants and subcontractors;

3. Provide assistance in identifying potential suppliers of equipment;

4. Contribute to final selection of consultants, subcontracts and suppliers of equipment. EAP will provide this service as a member of the bidding committee (if relevant) or through direct, formal consultation with DESA.

5. Provide comments on all technical reports produced by project subcontractors and consultants;

6. Provide comments on the Annual Performance Report regarding technical issues.

EAP's input will be provided as desk-top work and no travel is required. Documents requiring assistance or consultation on the above issues will be sent to EAP by UNDESA. EAP should provide written comments/inputs to UNDESA within ten working days upon receipt of the request. All final decisions regarding procurement and execution of project will be made by UNDESA.

Annex 8: Equipment List

This annex lists the 7 types of equipment to be purchased with GEF support.

The technical specifications for the equipment will be prepared during project implementation with the assistance of the project sub-contractors, and after the following project activities: training on equipment design, review of international best practices, study tours. The Project Management Office, the International Program Advisor, UNDESA and EAP will provide support to this process.

1. Supplementary monitoring for solar, wind and biogas:

Where data on the renewable energy resources potentially available at a site is not known, it will be necessary to take supplementary measurements and analyse the measurements. This applies particularly to solar\wind hybrid sites and to biogas sites.

Data-gap filling instruments: $501,000
The equipment includes portable wind speed monitors, portable solar insulation monitors, signalled and digital converters (to convert data into computer records), biogas analysis machines, and several small items for monitoring and registering data.

Total: $501,000 (all covered by GEF)

2. Solar simulator for hot water system certification:

A solar simulator system will be used to radiate solar water heaters in order to determine their specifications, prior to issuing quality certificates.

Solar simulator equipment:	$600,000
Power system:	$100,000
Record & report system:	$100,000
Installation & training:	$200,000
Total:	$1,000,000 (all covered GEF)

2. Maintenance and spare parts for solar and wind hybrid systems:
Back-up equipment and maintenance support will be needed for the systems. Over the duration of the project this is estimated to cost:

2 island systems :	$200,000
1 x 200 household systems:	$100,000
Total:	$300,000 (all covered GEF)

4. Wind data anemometers and data logging equipment for 9 locations:

This equipment is to measure the wind resources available at potential sites for on-grid wind-farms.

400 sets of wind speed record system for 9 locations: (The numbers of sets required for a single location varies from 10 to 60, dependant on the terrain. Overall 400 sets are required)	$650,000
Installation & Training:	$200,000
Record & report system:	$150,000
Total:	$1,000,000 (all covered GEF)

5. Hybrid solar, wind, battery, inverter, controller and grid distribution systems to cover 200 households and 3 villages. In order to install the systems it will be necessary to purchase:

200 sets of 60KW PV modules :	$300,000
4 sets of 50KW wind systems: (1 of the three villages is larger and will require two sets)	$300,000
200 sets of 300W wind turbines:	$140,000
200 sets of controlling system	$260,000
Total:	$1,000,000 (Total cost of the systems is estimated at $1.5 million, of which $1million in incremental cost to be covered by GEF)

6. Biogas cogeneration:for each sites:

GEF will contribute to constructing 3 biogas generators. Total cost to set-up the 3 sites is estimated at $3 million, of which $1million in incremental cost to be covered by GEF.

3 biogas digesters construction:	$750,000
100KW biogas power generator:	$ 60,000
Digester building equipment:	$150,000
Projects monitoring:	$ 40,000
Total:	$1,000,000

7. Bagasse cogeneration at 2 sites:

The establishment of the 2 co-generation sites is estimated to cost $10,000,000. Of this, $1 million is determined as incremental cost to be covered by GEF. As per the TOR, tasks 2 and 3 of sub-contract no. 10 are to design the sites and then specify the equipment requirements.

ANNEX 9.- PROJECT LOGICAL FRAMEWORK

Framework Level	Description	Sample Indicators	Risks, Key Assumptions, External Environment
Green-house Gas Reduction	Greenhouse gas emissions in the electricity-generation and heat-supply sectors decrease relative to the baseline. Potential reductions estimated up to 10 million tons CO2/year.	• Increased share of electricity and heat generated by renewable energy in the targeted markets • Increased share of newly installed capacity in the targeted markets that is renewable-based • CO2 sa vings from future renewable-energy investments linked to the original barrier-reduction interventions.	**Baseline Linkages:** What activities are occurring in the baseline that will affect or be affected by the activities in this project? How are baseline activities reflected in project indicators at each framework level? **World Bank Loan:** Loan for solar home-PV and wind-farm development expected for FY99. **Chinese Government:** New and Renewable Energy Development Program 1996-2010.
Market Response	Greater investments in renewable energy technologies occur as the following targeted markets respond over time to reduced barriers: • solar and wind hybrid systems for both community-scale (10, 30, 50 kW) and individual-home-system electricity generation (for 200 million people not connected to grids) • grid-connected wind farms for electricity generation • large-scale anaerobic biogas digesters (100-150 MW) • bagasse cogeneration • solar water heaters for residential applications	• annual installed capacity additions of solar and wind hybrid systems and wind farms • annual number of villages choosing to install community-scale biogas systems • increases in cogeneration capacity in the sugar industry • number of certified solar water heaters sold • number of independent power purchase agreements signed and fulfilled	**Market Potential:** These targeted markets are priorities and offer significant commercial opportunities for renewable energy development. **Energy Prices/Tax Credits:** Renewable energy technologies are cost-competitive in the target markets, through tax credits or other financial incentives for renewables. **Technology Diffusion:** Markets will continue to respond over time such that technologies continue to be diffused through the Chinese economy.
Barrier Reduction	The following key market barriers are reduced: National level: • Limited scale of existing investments in renewables • Lack of familiarity with successful market-oriented efforts to comercialize RET	• Market-based instruments will be developed • Alternative financing mechanisms will be in place	**Barrier-Reduction Necessity:** Market responses will be reduced or delayed unless at least these key barriers are reduced. **Barrier-Reduction Sufficiency:** Reduction of identified key barriers to a

Framework Level	Description	Sample Indicators	Risks, Key Assumptions, External Environment
Barrier Reduction (continued)	• Limited awareness and information of investment opportunities in RET • High up-front costs and lack of access to credit • Incomplete resource assessments • High transaction costs • lack of standards, codes of practice, and certification procedures for the renewable energy industry • Poor linkage from R&D to commercialization Residential and community solar and wind hybrid systems: • lack of familiarity with the technology by households, national and local officials, and businessmen Grid-connected wind farms: • lack of experience on windfarm performance and electric grid interaction parameters • low quality of current Chinese-produced wind turbines within a certain turbine capacity range • lack of experience with the economic and financial viability of wind turbines • inadequate policy environment, notably the lack of standard power-purchase agreements for independent power producers (IPPs) • limited availability of wind resource data Large-scale anaerobic biogas digesters: • lack of standardization of system designs and construction • inappropriate separation, control, and handling equipment • lack of familiarity with international best-practices and poor incorporation of existing experience into new plants • poor performance of small-scale systems leading to inadequate financial returns Bagasse cogeneration:	• Credit to small energy users of RET will be easier to be access • Information of RET investment opportunities will be available • A national renewable resource database will be available. • Codes, standards, and certification procedures will be developed and used in practice • the quality of domestically produced wind turbines increases • power-purchase agreement frameworks are in place and agreements are being signed • the availability and coverage of wind resource data increases • standardized biogas system designs become widely recognized and adopted • new biogas plants designs reflect international best-practices and existing Chinese experience • Chinese sugar industry managers possess necessary financial and engineering skills • sources of capital for bagasse cogeneration exist	sufficient degree will result in market responses; other barriers not addressed by the project are not critical to achieving market responses. **Time Lags:** Market responses will begin to occur soon after barrier reductions occur **Barrier-Reduction Sustainability:** Officials and managers trained remain in positions that affect renewable energy investments and production; codes and standards continue to be followed; databases remain accessible; power-purchase agreement frame-works remain viable; new biogas designs continue to reflect inter-national best-practices; sources of capital continue to be available. **Baseline Barrier Reduction:** Other baseline activities will not reduce these barriers to a sufficient extent in the time frame desired for achieving global benefits.

Framework Level	Description	Sample Indicators	Risks, Key Assumptions, External Environment
	• lack of standard power-purchase agreements • limited familiarity with higher-pressure boiler design • lack of the financial and engineering skills within the Chinese sugar industry needed for bagasse investments • insufficient capital available to the Chinese sugar industry Solar water heaters: • uncertainties about component and/or system quality of commercial products (lack of certification of products)	• commercially-available solar hot-water heater products are certified	
Activities and Tasks **Activities and Tasks (continued)**	National capacity building: • Establish a solid workplan for the project. • Create China Renewable Energy Industries Association to collect and provide information about renewables investment oportunities. • Train policy-makers, renewable energy professionals, and businessmen in renewable energy project development, business development, and financing. • Develop national capacities for financing renewable energy systems. • Develop national capacities for assessing renewable energy resources. • Develop national standards and codes of practice for renewable energy industry. • Establish certification capacity for solar water heaters. Residential and community solar and wind hybrid systems: • Strengthen hybrid technology center. • Install three community-scale pilot facilities (10, 30, 50 kW) connected to mini-grids, and closely monitor and evaluate their performance. • Install residential PV/wind/battery/inverter units in approximately 200 homes in a pilot region, and closely monitor and evaluate their performance. • Conduct training workshops, seminars, and study tours of manufacturing facilities and operating installations.	• quantity, timing, and quality of these activities	**Activity Sufficiency:** These activities taken together are sufficient to reduce the specific barriers given above. **Activity Sustainability:** Demonstration projects continue to operate; standards development is institutionalized; international best-practices are incorporated into on-going training programs and academic/professional curriculums.

Framework Level	Description	Sample Indicators	Risks, Key Assumptions, External Environment
Activities and Tasks (continued)	Grid-connected wind farms: • Provide international best-practices information in site selection, planning, O&M, and electricity utility grid integration. • Develop wind turbine standards. • Establish Wind Farm Development Departments within 3 selected utilities. • Seek IPP investors Large-scale anaerobic biogas digesters: • Design, develop, and demonstrate standardized and cost-competitive community-scale biogas plant designs. • Demonstrate best-practices and monitor the performance of biogas digestion plants of innovative or improved design. Bagasse cogeneration: • Develop capacity within the Chinese sugar industry to understand and undertake investments in bagasse cogeneration and to increase the efficiency of existing plants. • Review international best-practices. • Design and install a pilot plant of improved design. Local financing • Provide information on international experience with special funds for renewable energy • Conduct survey of demand and supply of credit for renewable energy		
Inputs	Total project cost $26.572 million GEF contribution $8.800 million	• disbursements, staff-years expended, contracts signed, project duration	Project plan and funding levels are sufficient to produce the stated activities and tasks.

Annex 10:- Incremental Cost Matrix

Component	Cost Category	Cost (US$000)	Domestic Benefit	Global Environmental Benefit
Activity 1.1 Establish a Sound Operational Basis for the Project	Baseline	$ 300	Capacity of project management	
	Alternative	$1830		Smooth and coordinated implementation of the Project.
	Increment	$1530		
Activity 1.2 Support the Establishment of CREIA with an IOF	Baseline	$1000	Fragmented RE promotion endeavors.	
	Alternative	$1800		CREIA established to promote renewable energy dev't.
	Increment	$800		
Activity 1.3 Build Capacities on Energy Externalities and Market Surveying	Baseline	$700 + $225 UNDP	Limited skilled professionals.	
	Alternative	$1755		Chinese professionals & policymakers provided RE skills
	Increment	$830		& info on worldwide experience.
Activity 1.4 Promote and Advance Investment in RE	Baseline	$100 + $175 UNDP	Limited capability on RE investment assessment.	
	Alternative	$715		Expanded renewable energy resource assessment capability.
	Increment	$440		
Activity 1.5 Prepare a Resource Inventory and GIS Applications	Baseline	$600 + $342.5 UNDP	Limited renewable resources assessment capability.	
	Alternative	$1942.5		National process to establish RE standards. Certification center selected & strengthened
	Increment	$1000		
Activity 1.6 Develop Standards	Baseline	$200	No standards have led to low quality of some renewable energy components	
	Alternative	$1060		National process to establish RE standards.
	Increment	$860		
Activity 1.7 Develop certification procedures for solar hot water systems	Baseline	$200	H2O Heaters limited by poor quality	
	Alternative	$400		Standards lead to improved quality in technology & greater consumer
	Increment	$200		confidence.

Component	Cost Category	Cost (US$000)	Domestic Benefit	Global Environmental Benefit
Activity 2.1 Removal of Barriers to Solar/Wind Hybrids	Baseline	$1000	Very limited info & experience re hybrids	
	Alternative	$2825		Expanded info & experience re hybrids. Financail/economic feasibility establ'd
	Increment	$1825		Ready for commercial development
Activity 2.2 Removal of Barriers to Windfarm Development Activities	Baseline	$1550	Limited info & experience on windfarm development.	
	Alternative	$2950		Windfarm sites info-base developed. Better quality medium turbines.
	Increment	$1400		Expanded info for windfarm development.
Activity 2.3 Removal of Barriers to Large Anaerobic Digestors	Baseline	$1900	Digestors profitable only for very large farms.	
	Alternative	$3400		New technology used to improve yield & profitability from livestock digestors.
	Increment	$1500	Local H2O quality imp'd.	Smaller units operate profitably.
Activity 2.4 Removal of Barriers to Bagasse Cogeneration	Baseline	$3650	No bagasse co-gen operational.	
	Alternative	$6645		Co-generation activity established-Engineering & Financing established for programme.
	Increment	$2995		
Activity 2.5 Assess the Demand for and Supply of Credit for the Purchase of RE	Baseline	$300	Very limited access to credit.	
	Alternative	$600		Increased access to credit for small power users.
	Increment	$300		
TOTALS	Baseline	$11,500 GOC $742.5 UNDP	Increase energy supplies, under baseline coal expansion.	
	Alternative	$25922.5Total	Reduced Local Air Pollution.	Reduced CO2 emissions
	Increment	$8150 GEF $5530 Bilat. $13,680 Total	Reduced BCOD water pollution.	Increased energy from renewable sources.