Document of
The World Bank

Report No: 18479-CHA

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$100 MILLION

AND A PROPOSED GEF GRANT OF US$35 MILLION EQUIVALENT

TO

THE PEOPLE'S REPUBLIC OF CHINA

FOR A

RENEWABLE ENERGY DEVELOPMENT PROJECT

May 5, 1999

Energy and Mining Development Sector Unit
East Asia and Pacific Regional Office

CURRENCY EQUIVALENTS

(Exchange Rate Effective June 30, 1998)

Currency Unit = Yuan (Y)
Y 1.00 = $0.12
$1.00 = Y 8.30

FISCAL YEAR

January 1 - December 31

ABBREVIATIONS AND ACRONYMS

km	=	Kilometer (= 0.62 miles)
kWh	=	Kilowatt hour (= 860.42 kcal)
MWh	=	Megawatt hour (= 1,000 kWh)
GWh	=	Gigawatt hour (= 1,000,000 kilowatt hours)
TWh	=	Terawatt hour (= 1,000,000,000 kilowatt hours)
kW	=	Kilowatt (= 1,000 watts)
MW	=	Megawatt (1,000,000 watts)
kV	=	Kilovolt (1,000 volts)
MVA	=	Megavolt-Ampere (1,000 kilovolt-amperes)
Wp	=	Watt peak
kWp	=	Kilowatt peak

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ABBREVIATIONS AND ACRONYMS

ADB	-	Asian Development Bank
AIC	-	Average Incremental Cost
BERI	-	Beijing Research Institute for Water Resources and Electric Power
BOT	-	Build-Operate-Transfer
CAS	-	Country Assistance Strategy
CIF	-	Carriage, Insurance and Freight
CO_2	-	Carbon Dioxide
EA	-	Environmental Assessment
EIRR	-	Economic Internal Rate of Return
EMP	-	Environmental Management Plan
ESCO	-	Energy Service Company
FIRR	-	Financial Internal Rate of Return
GDP	-	Gross Domestic Product
GEF	-	Global Environment Facility
GHG	-	Greenhouse Gas
GOC	-	Government of China
IBRD	-	International Bank for Reconstruction and Development
ICB	-	International Competitive Bidding
ICR	-	Implementation Completion Report
JJT	-	Jing-Jin-Tang
MOF	-	Ministry of Finance
MST	-	Ministry of Science and Technology (formerly SSTC)
NO_x	-	Nitrogen Oxide
NPV	-	Net Present Value
O&M	-	Operations and Maintenance
PCD	-	Project Concept Document
PDF	-	Project Development Funds
PIP	-	Project Implementation Plan
PIU	-	Project Implementation Unit
PMO	-	Project Management Office
PPA	-	Power Purchase Agreement
PV	-	Photovoltaic
RAP	-	Resettlement Action Plan
SHS	-	Solar Home System
SDPC	-	State Development Planning Commission
SETC	-	State Economic and Trade Commission
SO_2	-	Sulfur Dioxide
SP	-	State Power Corporation
SSTC	-	State Science and Technology Commission
TA	-	Technical Assistance
TI	-	Technology Improvement
TSP	-	Total Suspended Particulates
UNDP	-	United Nations Development Programme
VAT	-	Value-Added Tax

China
Renewable Energy Development Project

CONTENTS

China
Renewable Energy Development Project

Project Appraisal Document

East Asia and Pacific Region
Energy and Mining Development Sector Unit

Date: 05/05/99
Country Director: Yukon Huang
Project ID: CN-PE-46829; CN-GE-38121
Lending Instrument: IBRD Investment Loan

Team Leader: Noureddine Berrah
Sector Manager: Yoshihiko Sumi
Sector: Energy
Theme(s): Environmentally Sustainable Development
Poverty Targeted Intervention: [ ] Yes [X] No

Project Financing Data
[X] Loan [ ] Credit [ ] Grant [ ] Guarantee [X] Other [GEF]

For Loans/Credits/Others:
Amount (US$M): IBRD Loan $100 million; GEF Grant $35 million
Proposed terms: [ ] To be defined [ ] Multicurrency [X] Single currency (US$)
[ ] Standard Variable [ ] Fixed [X] LIBOR-based
Grace period (years): 5
Years to maturity: 20
Commitment fee: 0.75%
Service charge: n.a.
Front-end fee on Bank loan: 1.0%

Financing plan (US$M): (Includes contingencies, duties, IBRD loan service fee and IDC)

Source	Local	Foreign	Total
IBRD	0.0	100.0	100.0
GEF	12.3	22.7	35.0
SP/Power Companies	43.5	0.0	43.5
Domestic Commercial Banks/Other International Financial Institutions	37.7	74.4	112.1
Companies/End users	133.2	18.3	151.5
GOC (SETC)	2.0	0.0	2.0
Total:	**228.8**	**215.4**	**444.2**

Borrower: People's Republic of China
Guarantor:
Responsible agency: State Economic and Trade Commission, State Power Corporation

Estimated disbursements (Bank FY/US$M):

FY	2000	2001	2002	2003	2004	2005	2006
GEF Grant							
Annual	0.9	5.4	7.5	8.1	8.2	4.5	0.4
Cumulative	0.9	6.3	13.7	21.9	30.1	34.6	35.0
IBRD Loan							
Annual	0.0	32.5	52.5	15.0	-	-	
Cumulative	0.0	32.5	85.0	100.0	100.0	100.0	

Project implementation period: 5 years
Expected effectiveness date: 12/31/99 **Expected closing date:** 06/30/2005
Implementing agency: State Economic and Trade Commission (SETC)
Contact person: LIU Hongpeng
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Implementing agency: State Power Corporation (SP)
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A: Project Development Objective

1. Project development objective and key performance indicators: (see Annex 1)

The project aims at development of sustainable markets for wind and photovoltaic (PV) technologies, in order to increase supply of electricity in an environmentally sustainable way and improve access of isolated rural populations to electricity services. The project consists of: (a) installation of 190 megawatts (MW) of grid-connected windfarms in four provinces; (b) supply of about 10 MW of PV systems[1] to households and institutions in remote areas of six northwestern provinces; and (c) support for technology upgrading to improve the performance and reduce the costs of windfarm and solar PV technologies in China. Institutional strengthening is also provided to remove barriers to market development and commercialization of the technologies.

Key performance indicators are the following:
- avoided emissions of sulfur dioxide (SO_2), nitrogen oxide (NO_x) and total suspended particulates (TSP) as a result of thermal power generation replaced (tons);
- increased installed capacity of windfarms and PV systems as a result of the project (MW);
- increased electricity generation from windfarms (gigawatt hours—GWh);
- increased number of PV systems installed in households/institutions under the project (number);
- decreased capital cost of windfarms ($/kilowatt—kW) and PV systems ($/watt peak—Wp);
- number of local manufacturers with components that are certified to meet international/industry standards.

2. Project global objectives and key performance indicators: (see Annex 1)

The project's global objectives are to: (a) reduce greenhouse gas emissions by producing electricity from renewable energy; (b) reduce costs of renewable energy to permit long-term financial sustainability; and (c) remove barriers to the large-scale commercialization of the technologies. The key performance indicators are:
- avoided carbon dioxide (CO_2) emissions (tons);
- decreased capital costs of windfarms ($/kW) and PV systems ($/Wp);
- increased installed capacity of windfarms and PV systems (MW);
- number of local manufacturers with components that are certified to meet international/industry standards.

B: Strategic Context

1a. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

Document number: 16321-CHA Date of latest CAS discussion: May 28, 1998

The proposed project supports the CAS objectives of increasing electricity supply and protecting the environment. The project also increases the capacity of project entities to operate as effective corporate entities in a market environment and tap private financing sources. The linkage to the CAS objectives would be achieved directly by the physical and institutional components of the project, which would promote renewable energy power-generating facilities and develop institutional capacity and market infrastructure to support further large-scale installations. The project is also consistent with the

[1] The PV systems may be used in combination with small wind turbines to create PV/wind hybrid systems, as such hybrid systems are expected to be more cost-effective in some areas.

Government's stated goals of adjusting the balance between energy development and conservation, and developing alternative energy sources.

1b. Global Environment Facility (GEF) Operational Strategy/program objective addressed by the project:

The proposed project is fully consistent with GEF Operational Program 6, which supports the promotion of renewable energy by removing barriers and reducing implementation costs. GEF support would help to: (a) reduce information barriers to both investors and customers; (b) assist local commercial PV companies and wind developers to create sustainable businesses and expand their operations; (c) improve the quality of equipment and reduce implementation costs through economies of scale, competition and upgrading technology (where China has cost and production advantages); and (d) develop institutional arrangements needed to mobilize private financing for windfarms and PV systems. The specific barriers targeted by the project are detailed in section B.3.

2. Main sector issues and Government strategy:

Main Sector Issues. Despite the progress achieved during the last decade, China's power sector is still facing the following major issues: (a) heavy reliance on coal resulting in adverse health impacts, deteriorating air quality and increased acid rain damage from large emissions of greenhouse gases (GHG), SO_2, TSP, and NO_x; (b) inadequate financing of power infrastructure; (c) transmission bottlenecks; (d) inadequate wholesale electricity and transmission pricing structure (one-part tariffs, mostly used in China, are not conducive to economic dispatch because fuel costs are not clearly separated. However, unlike thermal projects, the proposed project is unlikely to be affected by this problem); (e) unclear corporate relationships between power sector entities; (f) low efficiency of electricity supply and use; and (g) lack of access to electricity by 75 million rural people.

Reform Strategy. The abolition of the Ministry of Electric Power in April 1998 and the transfer of its government regulation/supervision functions to the State Economic and Trade Commission (SETC) have paved the way for a clearer separation of government from enterprise functions and the initiation of a second wave of power sector reforms.

The main elements of the Government's future reform agenda are:

- Complete separation of generation from transmission and distribution functions. This strategy is being aggressively implemented in many provinces and all vertically integrated entities have been required to define a strategy to separate generation assets.
- Promotion of competition at the generation level, development of regional power markets, and in advanced provinces separation of transmission from distribution.
- Expansion and mainstreaming of successfully piloted strategies to raise private capital for and involve private developers in power sector development, such as: (a) build-operate-transfer (BOT) projects with full foreign ownership developed through competitive bidding; (b) joint investment projects with foreign investors; (c) domestic and foreign equity listing of power enterprises; and (d) securitization of existing generation assets to raise capital from private sources.
- Clarification of relationships between the State Power Corporation (SP), the regional power group corporations and the provincial power companies and development of sound corporate governance.
- Rationalization of wholesale generation tariffs and transmission tariffs, consistent with the complete separation of generation from the transmission and distribution assets.

Renewable Energy Strategy. The Government strategy also emphasizes the importance of development of renewable energy to reduce the power sector's heavy reliance on coal, in order to reduce GHG, TSP, NO_x and SO_2 emissions. Energy is the largest source of GHG emissions worldwide, and China accounts

for 10 percent of GHG emissions from energy use, behind the United States (21 percent), the former Soviet Union (18 percent), and Europe (21 percent). China's share is expected to grow because of its low energy consumption per capita, the size of its population and its rapid economic growth. However, macroeconomic and energy modeling work show that an aggressive program to promote energy conservation and renewable energy could limit the increase in GHG emissions between 1990 and 2020, under a high economic growth scenario, from a threefold increase to less than twofold.[2] Reducing local environmental damage from coal use is also essential, as annual health and agricultural losses associated with coal-related air pollution in China are estimated to be as high as 6 percent of gross domestic product (GDP).[3]

China's long-term energy strategy for rural development has relied and will continue to rely heavily on renewable energy. China has strongly supported small hydropower (less than 25 MW), biogas, and small wind turbines over the past 35 years, to provide energy and electricity to isolated rural populations. In 1995, the Government of China (GOC) renewed its commitment to renewable energy, in the *New and Renewable Energy Development Program, 1996-2010*, jointly developed by the State Development Planning Commission (SDPC, formerly the State Planning Commission), the Ministry of Science and Technology (MST, formerly the State Science and Technology Commission—SSTC) and SETC. This program aims at improving the efficiency of renewable energy technologies, lowering production costs and increasing its contribution to energy supply. The 1995 Electricity Law also extends support to solar, wind, geothermal and biomass energy for power generation.

Implementation-oriented studies were carried out by SETC, with Bank/GEF[4] assistance, during the preparation of the proposed project. The studies recommended that China develop a market-driven approach to renewable energy development that: (a) focuses on promoting commercial or near-commercial applications; (b) combines international advances in technology with demonstrated Chinese low-cost production capabilities; and (c) taps the large potential market demand by lowering product costs and improving system reliability as well as consumer services.

3. Sector issues to be addressed by the project and strategic choices:

The project would address directly the following sector issues:

- Heavy reliance on coal (windfarm, solar PV, and technology improvement components);
- Inadequate financing of power infrastructure and barriers to private investment (windfarm and solar PV components);
- Inadequate wholesale electricity pricing systems (windfarm component); and
- Insufficient access to electricity by rural households in remote areas (solar PV component).

Following recommendations from the sector studies described above, the project supports the two most promising renewable energy technologies, grid-connected windfarms and solar PV for off-grid rural applications. In order to reach its objectives, the project seeks to address the following barriers to developing markets for windfarm and solar PV technologies (components to address barriers are indicated in parentheses):

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2 See *China: Issues and Options in Greenhouse Gas Emissions Control, Summary Report*, joint report of the Chinese Government, UNDP, and the World Bank, December 1994, p. 33.

3 *Clear Water, Blue Skies: China's Environment in the 21st Century*, East Asia and Pacific Region, World Bank, 1997.

4 A GEF PDF Block B Grant was approved in September 1995, to support this analytical program effort. Reports published include the following: *China: A Strategy for International Assistance for Accelerating Renewable Energy Development*, 1997 (World Bank Discussion Paper No. 388); *China: Renewable Energy for Electric Power*, 1996 (World Bank Report No. 15592-CHA); and *China: Renewable Energy Development for Thermal Applications*, 1997.

Barriers to Windfarm Development

Higher Generation Costs Than Coal-Fired Thermal Power Plants. Two main factors have contributed to high costs of windfarm projects in China: (a) projects have been small (less than 20 MW); and (b) they have been financed through bilateral aid and credits that did not allow international competitive bidding. Larger-scale development and competition are needed to lower windfarm costs in China to the levels of conventional alternatives, mainly coal-fired thermal power plants. In addition, experience in conventional power generation shows that windfarm and PV equipment costs could be lowered significantly by taking advantage of China's comparative advantages in industrial production. Barriers to local production include: (i) insufficient market to justify investments in the industry; (ii) lack of access to state-of-the-art technologies; and (iii) capital constraints including the limited access of local wind turbine manufacturers to financial markets (windfarm and technology improvement components).

Lack of a Legal Framework for Windfarm Projects. Despite world-class sites and interest by international investors, development of windfarms in China has been constrained by the length and difficulty at local and national levels in negotiating legal agreements for power purchase, land lease, grid interconnection and other issues (windfarm component).

Lack of Institutional Capacity. Development of windfarm capacity in China has been led by government research institutes or recently established companies under provincial power companies. Windfarm development has focused largely on noncommercial demonstration projects, with limited joint-venture investments. Newly established windfarm development companies do not yet have strong technical, financial and legal capacity to initiate or participate in project development (windfarm component).

Inadequate Information on Wind Resources, Site Characteristics, and Equipment Performance. There are few wind monitoring stations and the collection and analysis of wind resource data have been limited. In addition, information that has been collected on selected sites, long-term data from meteorological stations, topographical maps, and data on the performance of installed wind turbines have not been made available to interested potential investors (windfarm component).

Barriers to PV System Development

Small Scale and Relatively Inexperienced Companies. Companies are small and have technical rather than commercial experience. Businesses are growing mainly on the basis of retained earnings. It is difficult for PV system companies to obtain bank loans to expand because of their small size, informal record keeping and accounting, and lack of credit record (solar PV component).

Poor-Quality Products and Service. While sales have expanded quickly, problems are evident in both the quality of systems and after-sales service. PV companies sell locally made and uncertified PV modules that are of uncertain quality and often overrated. In order to keep costs down, many smaller systems are sold without controllers, which can shorten battery life and raise life-cycle PV system costs. Because of the lack of after-sales service, when components fail or need replacement, the system is out of service until the user can obtain replacements from the nearest supplier, often at a considerable distance. If these problems are not corrected, they could seriously damage market potential (solar PV component and technology improvement component).

High Cost/Lack of Mechanisms to Increase Affordability. PV systems are high-cost consumer durables—the cost of a 20 Wp system, including value-added tax (VAT), is about Y 1,600 (about $200). Consumer credit is not widely available even in urban areas of China. Therefore, the market for PV systems is made up mainly of households that can afford to pay cash, for small systems of 10-30 Wp. Cash sales have grown steadily over the last three years and are expected to continue to grow as the

geographical sales area expands. However, for long-term sustainability, it is important to deepen the market by providing financing to enable wealthier households to purchase larger systems and poorer households to afford the small systems (solar PV component).

C: Project Description Summary

1. Project components: (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown)

Component	Category	Cost Including Contingencies* ($M)	Percent of Total	Bank financing ($M)	Percent of Bank financing	GEF Grant
1. Windfarm Component:		208.7	47	100.0	47.9	3.0
A. Investment in 190 MW	Physical	202.7	45	100.0	49.3	0.0
B. Institutional Strengthening	Institution Bldg.	6.0	1	0	0	3.0
2. PV Component:		155.9	35	0	0	22.0
A. Investment in 10 MW of PV systems	Physical	144.9	33	0	0	15.0
B. Market Development Program	Institution Bldg.	7.0	2	0	0	5.0
C. Institutional Strengthening	Institution Bldg. / Proj. Mgmt.	4.0	1	0	0	2.0
3. Technology Improvement Component (Wind and PV):						
A. Investment	Physical	79.6	18	0	0	10.0
B. Institutional Strengthening	Institution Bldg.	78.0	18	0	0	9.0
	/Proj. Mgmt.	1.6	0	0	0	1.0
TOTAL		**444.2**	**100**	**100.0**	**22.5**	**35.0**

* Includes IBRD loan service fee and IDC.

Windfarm Component

Investment ($202.7 million). Windfarm companies (subsidiaries of SP and provincial/municipal power companies) will install 190 MW of windfarms at five sites. Each windfarm will be developed on a commercial basis, using power purchase and other commercial and legal agreements that will pave the way for private-sector participation in future wind power projects. The windfarms include: (a) initial large installations at Huitengxile, Inner Mongolia (100 MW on a site with 1,000 MW potential) and Zhangbei, Hebei (50 MW on a site with 500 MW potential); (b) an installation at Pingtan, Fujian (20 MW on 120 MW site); and (c) very small windfarms at Chongming Island and Nanhui, Shanghai (20 MW total). The first three sites are all prime sites with capacity factors of more than 30 percent and easy access to major power grids. The sites in Shanghai are smaller and have lower capacity factors. They are included mainly to promote the technology in locations with high public visibility.

Institutional Strengthening ($6 million, $3 million GEF). GEF-assisted technical assistance (TA) and capacity building would be provided to staff of SP, the windfarm companies, and others to overcome barriers to windfarm development in the following areas:

- **Private-Sector Development of Windfarms in China ($3.6 million, $1.8 million GEF).** This task would assist in: (a) developing a strategy to encourage private-sector development of windfarms; (b) preparing packages for potential investors to develop blocks on one or two large windfarm sites (several hundred MW in total) through private sector financing. The packages would include technical, legal and contractual documentation for the sites; and (c) training SP and windfarm company staff on technical, legal, financial, and contractual requirements for obtaining private investment.

- **Collection, Analysis, and Dissemination of Performance Data for Windfarms ($300,000, $150,000 GEF).** This activity would assist in the preparation and publication of an annual technical report on China's windfarms. The information would help gauge the technical performance of the windfarms and would provide critical information to prospective investors and lenders.
- **Financial Management and Organizational Structure Assistance ($1 million, $500,000 GEF).** This activity would provide consultant services and training to assist the new windfarm companies to have adequate financial management and accounting systems as well as a sound organizational structure, to ensure commercial orientation and future access to financial markets.
- **Engineering, Construction Management, and Operations and Maintenance (O&M) Management Services ($700,000, $350,000 GEF).** This activity would fund consultants to assist the windfarm companies to establish the capacity to build, operate and maintain commercial-scale windfarms to international standards.
- **Capacity Building ($400,000, $200,000 GEF).** This activity would provide consultant services and training to address technical, policy and/or institutional issues associated with wind power.

Solar Photovoltaic (PV) Component

Investment ($144.9 million, $15 million GEF). A direct grant would be provided to PV system companies to assist them to market, sell, and maintain about 10 megawatt peak (MWp) of PV systems, an estimated 300-400,000 systems, in Qinghai, Gansu, Inner Mongolia, Xinjiang, Tibet, western Sichuan and adjacent areas. The systems are expected to be purchased mainly by households and institutions living in isolated rural areas without access to electricity. They would be used to power lights, radios, televisions, and other appliances. The companies would receive a GEF grant of $1.50 per Wp of PV capacity, per system with a capacity of 10 Wp or greater. This financial support would assist companiesto: (a) improve PV product quality; (b) improve warranties and after-sales service; (c) strengthen business capabilities; and (d) increase marketing efforts. Competition among companies would be encouraged to reduce system costs and improve service.

Market Development Program ($7 million, $5 million GEF). The direct grants will be complemented by support to the companies to assist PV market development. The Project Management Office (PMO) will manage the program, which is aimed at overcoming barriers and developing markets for PV systems, through activities including:

- a public information campaign to give consumers objective information about PV system performance and costs;
- capacity building to increase the commercial capabilities of staff of PV companies in marketing, development of sales and service networks, after-sales service, accounting, financial management, etc.;
- a study to assess options for payment mechanisms to increase affordability (including trade-ins, consumer financing, barter trade, etc.), followed by the provision of financial assistance from the GEF to implement the most promising option(s);
- market monitoring, obtaining feedback from consumers and companies, consumer protection activities; and
- other activities such as small-scale demonstrations in high-visibility locations.

While indicative budgets have been established for each of the above activities to provide a framework for the program, implementation would be flexible and responsive to market developments. It would be defined in detail on an annual basis, within the strategic framework outlined in Annex 2. *Because of the flexible approach being taken to implementation of market development activities, this component will require special attention during the Bank's semiannual supervision missions.*

Institutional Strengthening ($4 million, $2 million GEF). To strengthen institutional capabilities for PV quality assurance and project management, the following activities would be supported: (a) capacity building for product quality assurance, including establishing national PV testing and certification centers; establishing national PV component and system standards; and improving quality control procedures of PV equipment suppliers; and (b) project implementation and management, including project monitoring and evaluation.

Technology Improvement Component

Investment ($78 million, $9 million GEF). This program would provide financial assistance to industries producing wind or PV equipment, to accelerate technology innovation aimed at reducing costs while providing high-quality products and performance. *Seventy percent of the grant and loan funds would go to projects supporting wind equipment; 30 percent to projects supporting PV equipment.* The program would have three elements:

- **Grant-Assisted Technology Improvement Projects ($16 million, $8 million GEF).** Grants would be provided to share up to 50 percent of the costs of projects. Beneficiaries would be selected competitively, based on proposals submitted by companies or institutions, in response to invitations that would be issued periodically by the PMO. Proposals would be evaluated and ranked by technical experts (including international experts), and selected by the PMO based on the ranking, subject to the GEF/Bank's no-objection.
- **Grant-Assisted Small Technology Improvement Projects. ($2 million, $1 million GEF).** There would be a quick response fund with a limited budget that would be administered by the PMO for grant amounts for small and urgent cost-shared projects that would provide grants of up to $10,000 per project.
- **Production Investment Projects Assisted by Loans ($60 million).** Loans would be available to companies, through commercial banks and assisted by SETC, for purchase of production equipment, follow-up investments to grant-financed activities, or other investment activities. The assistance to companies from SETC would be the same as or similar to that offered for loans under SETC's Technical Retrofitting Program, which currently provides a subsidy of up to 50 percent of commercial interest rates. Companies would make an equity contribution of $10 million, while $50 million would be made available by commercial banks.

It should be noted that the cost of the Technology Improvement (TI) Component increased from $30 million in the Project Concept Document (PCD) to $79.6 million. The main reason is that wind and PV companies indicated the need for support for investments in production equipment and other follow-up investments to grant-financed activities. To solve this problem, SETC proposed to substitute the subsidy of up to $50 million in concessional loans for its proposed grant contribution of $10 million. Further, the need for institutional strengthening for technology improvement has resulted in the proposed reallocation of $1 million in GEF grant financing to these activities (see below).

Institutional Strengthening ($1.6 million, $1 million GEF). Support would be provided for (a) program management, including monitoring and evaluation, and preparation of the annual plan; and (b) institutional strengthening activities such as improving the capacity of staff in manufacturing companies in areas such as contracting and legal aspects of technology transfer agreements, and carrying out special studies needed to better implement the project.

2. Key policy and institutional reforms supported by the project:

The proposed project would support institutional reform by:

- increasing the commercial orientation and improving the corporate governance of windfarm and PV companies;

- promoting internationally accepted power purchase agreements (PPAs) and other legal arrangements based on international commercial practices for developing wind power projects;
- diversifying sources of financing and encouraging private investment in windfarm projects; and
- supporting GOC efforts to provide consumer protection by introducing and enforcing quality standards for products.

GOC has already implemented a number of important policy measures, based in part on previous sector work (see Annex 4), especially the recommendations of the Bank-supported "China: Financial Incentive Policy for Renewable Energy Technical Assistance." Among others: (a) renewable energy projects were made eligible for duty and VAT exemptions on imported equipment in January 1998; and (b) power pricing based on full cost recovery ("new plant, new price policy") has been extended to windfarm projects, providing an incentive for investment by guaranteeing a price sufficient to repay debt plus operating costs and a reasonable profit. Other measures, not sought by the Bank but not detrimental to achievement of the project's development objective, are still under consideration. These include: (a) reduction in VAT on output to 6 percent for windfarms (already in place for small hydro); and (b) concessional long-term financing for windfarm and solar PV development from government policy banks.

3. Benefits and target population:

In addition to the value of the electricity generated, the benefits of the project include: (a) environmental benefits; (b) social benefits from improved access of rural populations to modern energy; and (c) economic benefits from business activities generated by local PV and windfarm companies and equipment suppliers.

Calculations carried out during project preparation (and available in Project Files) indicate that: (a) installation of 190 MW of windfarms is estimated to result in direct avoided emissions of 8.5 million tons of CO_2 over 20 years; and (b) the PV component is expected to result in direct avoided CO_2 emissions of 4.3 million tons over 20 years. Associated emissions avoided as a direct result of the project are expected to total: 60,000 tons of TSP, 39,000 tons of NO_x and 126,000 tons of SO_2, all over 20 years. Moreover, achievement of the project's development objectives would reduce emissions by several times the direct effect, in the long term, as a result of accelerated wind power and solar PV development outside the project. The project is expected to generate incremental environmental benefits (both direct and indirect) of 17.2 million tons CO_2 (see Annex 5).

The PV component is targeted mainly to provinces with annual net rural incomes per capita well below the national average (Y 1,195-1,780 compared to the national average of Y 2,090 in 1997). The PV systems sold would provide electricity to more than a million people living in isolated and dispersed rural communities who otherwise would not have access to electricity. Many of these communities are in areas targeted for government poverty alleviation programs. Use of PV systems in these isolated communities would result in improved quality of illumination and access to communication in homes, schools and health clinics. This would enhance the quality of life, reduce isolation, increase access to knowledge, and support education and community development. PV systems also have economic benefits; e.g., herdsmen use lights as a beacon to prevent animals from straying from the herd. Other benefits to the local communities and nearby urban centers would include increased employment and tax revenues from PV businesses, most of which are owned by local entrepreneurs.

The project would benefit: (a) people living in areas with great wind potential, such as the northwestern provinces and coastal regions; (b) rural households in isolated areas of the poor northwestern regions that would have increased access to electricity; (c) people living in areas where harmful emissions would be avoided; (d) the small PV system companies that would acquire improved commercial skills and opportunities; (e) the windfarm companies that would benefit from increased technical, operational and

financial skills; and (f) PV and wind equipment manufacturers that would benefit from support for technology upgrading.

4. Institutional and implementation arrangements:

Overview. SETC, as the government agency in charge of commercialization of renewable energy, is the agency responsible for overall project coordination and for implementation supervision of the PV and Technology Improvement Components. SP, which has a long history of cooperation with SETC in windfarm development, is responsible for coordination of the grid-connected windfarm component. A project leading group made up of various ministries involved in renewable energy development provides overall policy guidance on project implementation. Institutional arrangements are detailed below.

Implementation Period. Five years, from end-1999 to end-2004.

Project Oversight and Policy Guidance. A project leading group provides overall policy guidance. This group is chaired by a Vice Minister of SETC, and includes representatives of the Resource Conservation and Comprehensive Utilization Department of SETC; the Departments of Basic Industries and Foreign Capital Utilization of SDPC; the Ministry of Finance (MOF); the Hydropower and New Energy Development Department of SP; the Department of Industries of the Ministry of Science and Technology (MST); the Department of Environment and Energy, Ministry of Agriculture; and the State Environmental Protection Agency. There is a similar project leading group at the provincial level in most provinces participating in the project.

Project Coordination. A PMO, already operating under SETC, is responsible for overall project coordination, assisted by other agencies at the central and provincial level. The PMO is chaired by the Deputy Director of the Resource Conservation and Comprehensive Utilization Department and managed by the Chief of the Renewable Energy Division. The PMO is assisted by a technical support group of domestic and international consultants. For the PV Component, a Project Implementation Unit (PIU) has been created under the Provincial Economic and Trade Commissions (ETCs), in provinces participating in the PV Component, to facilitate the ability of the PMO to coordinate activities at the provincial level. For the Windfarm Component, the Hydropower and New Energy Development Department of SP is responsible for coordinating project implementation.

Executing Agencies

Windfarm Component. SP is the beneficiary of the proposed loan and would be responsible for timely mobilization of all project financing, including obtaining any foreign exchange required in addition to the IBRD loan. All IBRD financing would be onlent by SP to the windfarm companies that are being established under the Company Law to develop and operate each windfarm.[5] SP would also be responsible for procurement; preparation of legal agreements for all sites, including PPAs, land lease, grid-interconnection and disbursement of funds. Each windfarm company would be responsible for project preparation, implementation and operation, including construction supervision. Although the windfarm companies would be new, each of the provincial/municipal power companies and provincial/

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[5] The process of incorporating the windfarms is under way. A draft charter has been prepared as a model. During negotiations, it was agreed that an effectiveness condition would be legal establishment of the Inner Mongolia Windfarm Company, accompanied by a restriction on disbursements to $53 million until all windfarms have been established, and a requirement that all windfarm companies be established by June 30, 2000. Each windfarm company would be jointly owned by SP and the respective provincial/municipal electric utility. For the Huitengxile Windfarm Company, SP will contribute 51 percent and Inner Mongolia Electric Power Company 49 percent. For the other three windfarm companies, SP will contribute 33 percent with the balance of 67 percent coming from the respective provincial and municipal power companies.

regional design institutes involved has experience with construction and operation of large conventional power plants.

SP would be responsible for implementation of the GEF-supported institutional strengthening activities under this component.

PV Component. The GEF financial assistance under this component would be managed by the PMO, which would be responsible for:

- determining the eligibility of PV system companies to participate in the project and receive the GEF direct grant per system sold, subject to the no-objection of the Bank;
- verifying sales and authorizing payment of the direct GEF grant to participating companies;
- monitoring company performance and consumer satisfaction;
- monitoring market development and obtaining feedback from consumers and PV companies;
- implementing the Market Development Program, including preparing an annual program within the strategic framework outlined in Annex 2; and
- implementing technical assistance on product quality assurance and project management.

The PIUs would assist the PMO in monitoring PV system sales and providing sales information; and monitoring project implementation, product performance, system costs and customer satisfaction. However, all management decisions would be made by the PMO at the central government level, including selection of companies, certification of equipment and authorization of grant payments.

The PV system companies will sell PV systems,[6] offer warranties, provide maintenance and repair services, and work with the PMO to develop payment mechanisms to increase affordability to their customers.[7] Seventeen PV system companies are receiving business development assistance as part of project preparation (see Annex 4). This assistance is helping them to develop business plans, obtain financing, and put in place the arrangements needed to expand sales and improve after-sales service. It is expected that more than 10 PV system companies would ultimately be eligible to participate in the project. To be eligible, the PV companies would need to meet minimum requirements: (a) offer products that are certified to meet quality standards; (b) offer warranties and demonstrate capability for adequate, on-the-ground sales and service; (c) prepare a viable business plan for expanding sales and service that is acceptable to the Bank; (d) agree to abide by a code of norms; and (e) agree to establish an escrow account using a small percentage of the grant funds received, for consumer protection.

Technology Improvement Component. The GEF financial assistance provided under this component would be managed by the PMO, which would: (a) offer grants to cost-share investment projects in technology innovation for wind and PV equipment; and (b) provide assistance to companies to obtain loans from banks. The beneficiaries of the program would be: (a) companies that produce windfarm or PV systems or components (or are interested and capable of doing so); and (b) institutions whose activities are directly related to development of PV and wind system components, if their projects contribute directly to the program objective. The companies/institutions would apply for and be awarded grants, based on a competitive process. Selection criteria would be: (a) the extent of the project's contribution to the objectives of cost reduction and quality improvement; (b) its cost effectiveness; and (c) the probability of its success. The PMO would be responsible for:

- promoting the program and increasing the awareness of the industry about the opportunities for technology improvement;

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6 The PV system can be part of a PV hybrid, but the grant would be given only for the PV capacity.

7 Possible mechanisms include: (a) dealer financing or installment payments to spread the costs over time; (b) loans from rural credit cooperatives or banks to individuals, institutions or communities; and, (c) trade-in of previously purchased systems to purchase larger or improved systems.

- actively soliciting and assisting companies to prepare proposals for grant-assisted projects, which would include a business plan showing targeted results;
- issuing an invitation for proposals once per year, indicating the funding available, the technology areas to be supported, and the guidelines for application;
- evaluating and ranking the proposals and selecting projects to be supported each year, subject to the no-objection of the GEF/Bank;
- concluding contracts with the companies/institutions for delivery of the results;
- monitoring implementation of projects and authorizing disbursement of the grant to participating companies in relation to milestones achieved;
- monitoring technology improvement achieved by the program and obtaining feedback from participating companies/institutions and from the marketplace;
- implementing capacity building and other institutional strengthening activities;
- preparing progress reports, including specific monitoring data and evaluations.
- assisting companies to prepare bankable project proposals for follow-up investments; and,
- assisting companies to obtain loans from commercial banks, and to obtain financial assistance from SETC for follow-up investments.

The companies and institutions would execute the technology improvement projects. Eligible technology areas would be defined in each annual plan in relation to the overall implementation strategy.

Onlending and Auditing Arrangements. The proposed Bank loan of $100 million (including the 1 percent service fee) would be made to the People's Republic of China at the Bank's standard interest rate for LIBOR-based US dollar single currency loans, with a maturity of 20 years, including a 5-year grace period. Proceeds of the loan would be onlent from the Borrower to SP on the same terms and conditions as the Bank loan. SP shall make the proceeds of the loan available to the windfarm companies under terms and conditions agreed during negotiations, and at the same interest rate and repayment period as applicable to the Bank loan. The windfarm companies shall bear the foreign exchange risk.

The proposed project will be audited by the representative offices in Inner Mongolia, Hebei, Fujian, and Shanghai of the State Audit Administration (SAA). These offices have prepared audit reports on each provincial/municipal power company's accounts in connection with previous Bank projects, in accordance with Chinese audit principles and standards, which are generally consistent with international practices.

Project Financial Management System

The Bank's certified financial management specialist at the Resident Mission in China has evaluated the project's proposed financial management system (see Annex 6 for details). The description of accounting and financial management procedures in the evaluation was discussed and agreed with the Borrower and beneficiaries during negotiations. A brief summary is given below.

SP. SP will use accounting standards for joint stock companies issued by MOF, and follow financial management regulations for World Bank projects issued by MOF. SP will provide to the Bank biannual financial reports for each windfarm project and for the institutional strengthening component of the project, by March 15 and September 15 of each year. These reports will use the standard project financial reporting package agreed by MOF and the Bank. Moreover, SP will furnish to the Bank the audited accounts for each windfarm project, and for the institutional strengthening component of the project within six months of the end of each reporting year. In this regard, SP and each windfarm company would also implement any changes to their accounting practices as recommended by the financial management consultants, require the auditors to comply with international auditing practices and provide an audit plan

prior to each audit. TA is provided under the project to strengthen the accounting and financial management capabilities of SP project staff and the windfarm companies.

Finally, SP will furnish to the Bank a rolling eight-year financial plan for each windfarm company, including projected income statements, fund flow statements, and balance sheets, by June 30 of each year.

PMO. Because of the PMO's responsibility for management of the major portion of the GEF grant, special attention has been paid to its financial management procedures, including defining auditing and financial management systems, staffing, accounting and auditing policies, arrangements for financial management, and reporting requirements (see Annex 6 and Project Implementation Plans—PIPs—for the PV and Technology Improvement Components.) The PMO will also follow regulations for financial and accounting management for World Bank projects issued by MOF, and provide biannual reports using the standard financial reporting formats agreed between MOF and the Bank. These reports will be submitted by the PMO to the Bank by March 15 and September 15 of each year.

In order to be eligible to participate, the PV system companies must meet specific financial criteria. They would be required to submit business plans and audited financial statements in order to be considered for participation in the project. Participating companies would continue to submit audited statements within six months of each year thereafter. Indicators that require careful monitoring include sales, net return on equity (with and without GEF grant), net return on assets (with and without GEF grant), and the current ratio (see Annex 6). Presently, the accounting and financial management systems of the companies are inadequate to meet the needs of their expanding businesses and the project's reporting requirements. Assistance is being provided during preparation and will continue during implementation to assist companies to have adequate financial documentation and management.

The PMO would follow financial management procedures similar to those defined above for the Technology Improvement Component. These procedures are defined in the Technology Improvement Component PIP.

D: Project Rationale

Support for windfarms and solar PV systems is based on previous sector studies (see Annex 4). The project will include investment in large-scale windfarm projects, to reduce costs, combined with technical assistance to create institutional capacity for further investment. For solar PV, the project will accelerate market development by providing financial and technical assistance to strengthen PV companies and enable them to expand sales, improve product and service quality, and make systems more reliable and affordable to users. Technology improvement would contribute to cost reduction for both wind and PV, improved equipment performance and sustainability.

1. Project alternatives considered and reasons for rejection:

Several alternatives to the proposed project were considered and rejected. The team considered providing only a line of credit to support renewable energy projects. However, lessons learned from other projects suggest that an active approach of providing financing and grants for a sizable investment in these technologies, combined with institutional support and technology improvement, would be more effective in strengthening commercial infrastructure and assisting the development of renewable energy (see Section 3). A second approach considered was a broader project that would have included components to support other commercially attractive technologies such as solar hot-water heating, and bagasse cogeneration. While such support might be justified, this option was rejected to avoid fragmentation of effort.

Private financing was considered for the windfarm component. However, nonutility independent power projects have been difficult to establish in China, even for conventional coal plants. It was, therefore, decided to assist GOC in taking the initial steps for encouraging private-sector participation. The windfarm projects would be developed by newly formed government-owned limited-liability windfarm companies that would sell electricity to the respective provincial utilities under power purchase agreements (developed during project preparation). TA is provided to develop a strategy for private-sector development of windfarms and to assist local agencies in developing one or two large windfarm sites (several hundred MW) through international and local financing.

For the PV component, the team decided to build on the growing commercial market for sales of individually owned household scale PV systems rather than using an Energy Service Company (ESCO) model. The team considered giving the GEF direct grant only for sales of larger systems and requiring the PV companies to offer the option of credit purchase, as has been done in other Bank projects. However, as rural consumer credit is virtually nonexistent in China, the concept was redesigned to allow the companies the maximum flexibility to decide on the type of systems to be sold, the target markets they would serve, and the options for payment they would offer, while creating the incentive for the companies to increase quality and reduce cost. The project addresses the issue of consumer credit through the Market Development Component, where the PMO will investigate, recommend and support mechanisms to encourage consumer credit for PV, through banks, rural credit cooperatives or the PV system companies.

2. Major related projects financed by the Bank and/or other development agencies:

Sector issue (Identified by letter, in Para. 1, section B2)	Project	c-completed o-ongoing p-planned	Latest Supervision (Form 590) Ratings (Bank-financed projects only)	
			Implementation Progress (IP)	Development Objective (DO)
Bank-financed: China				
Issues: b, d	Tianhuangping Pumped Storage Project	c	HS	HS
Issues: b,d,e,a	Waigaoqiao Thermal Power Project	o	S	S
Issues: b,d,e,a,f	Tuoketuo Thermal Power Project	o	S	S
Issues: b,d,a,f	Zouxian Thermal Power Plant	c	HS	S
Issues: b	Wujing Thermal Power Project	c	HS	HS
Issues: b,d	Yangzhou Thermal Power Project	o	S	S
Issues: b,e,a	Zhejiang Power Development Project	o	HS	HS
Issues: f	Energy Conservation Project	p	S	S
Other agencies: China				
Issue: f	ADB (TA No.1867-PRC) Power Subsector Energy Conservation in Jiangsu Province	c		
Issue: f	ADB (TA No.2789-PRC) Strengthening Demand Side Management in Guangdong and Zhejiang Province	o		
Issue: a,b,g	UNDP/GEF China: Capacity Building for the Rapid Commercialization of Renewable Energy	p		
Issue: a,b	ADB Wind power Development Project	p		
Issue: a,b,	ADB: Renewable Energy Project	p		
Other Countries:				
	IBRD/GEF Indonesia: Solar Home Systems Project	o	U	U
	IBRD/GEF India: Renewable Resources Development Project	o	S	S
	IDA/GEF Sri Lanka: Energy Services Delivery Project	o	S	S
	IDA/GEF Lao PDR: Southern Province Rural Electrification	o	S	S
	IBRD/GEF Argentina: Renewable Energy in Rural Market Project	p		
	IBRD/GEF Cape Verde: Energy and Water Reform Project	p		

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

GOC, the World Bank and UNDP have developed a joint approach for GEF support to renewable energy development in China. The proposed GEF/IBRD project focuses on large-scale windfarms and commercial development of PV systems for rural applications. The UNDP GEF-supported project focuses

on capacity building for assistance for renewable energy in general, and for four specific technologies—solar PV hybrid systems, windfarms, medium- and large-scale anaerobic digesters, and bagasse cogeneration. The UNDP and IBRD projects have been carefully designed to address the issues identified in previous studies and to avoid redundancy. For solar PV, the UNDP project would demonstrate new solar PV hybrid systems, which could be disseminated under the World Bank/GEF project. For windfarms, UNDP proposes to assess international experience with windfarm development, assist utility planning for windfarm development, and carry out project prefeasibility assessments.

3. Lessons learned and reflected in the project design:

While energy sector projects in China have satisfactory or highly satisfactory ratings, lessons learned include: (a) the need to set specific and achievable objectives for power sector reform; (b) the need for a systematic approach to procurement including capacity building of implementing agencies; and (c) the need for early government approval of projects. These lessons, especially those about the need for specific goals and for a systematic approach to procurement, have been taken into account during project design and preparation. Capacity building of the PMO and implementing agencies in procurement has been carried out during project preparation and will continue during project implementation, as needed. Also, an international consultant has advised SP on preparation of the technical specifications for bids and prequalification of suppliers in the windfarm component.

Most of the renewable energy projects listed above are in early implementation. However, lessons have been drawn from older Bank projects and from international experience, including:

- **Windfarms.** The project design builds on the Bank's experience with conventional power sector projects in China, which have (a) achieved significant cost reduction through economies of scale and local production of components in thermal and hydro plants; and (b) financed utility-owned projects as a first step to prepare PPAs and other commercial documents leading toward private investment. The project design also incorporates recommendations of the "China: Financial Incentives Policy for Renewable Energy Technical Assistance." The study summarized the experience of six leading countries in wind power development.[8] It indicated the importance of contractual frameworks that provide a financial incentive based on production levels (e.g., a premium price) combined with competition, to encourage efficiency and the convergence of wind power and conventional power costs.
- **PV Systems.** Lessons from the India Renewable Resources Development Project have been incorporated into the project design including: (a) the need to strengthen the commercial capabilities of PV companies and other participants such as testing centers before project startup; (b) the need to allow use of commercial procurement practices rather than international competitive bidding (ICB), given the small transactions involved; (c) the ineffectiveness of providing a line of credit where there are not yet informed consumers; (d) the need to provide financial resources directly to PV distribution companies to expand their sales and service networks; and (e) the importance of quality assurance procedures and ensuring consumer satisfaction. Lessons incorporated from other Bank projects in Indonesia and Sri Lanka are: (a) the concerns of the key participants—PV companies and consumers—must be taken into account; and (b) flexibility must be built into project design so that it can be adapted to changing market conditions during implementation. This project has been designed in close collaboration with the PV system companies, to allow maximum flexibility to the companies to respond to market conditions. In addition, lessons learned from other non-Bank projects are being incorporated in project design.[9]

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8 See *Financial Incentives for Renewable Energy Development: Proceedings from an International Workshop*, August 1998 World Bank Discussion Paper No. 391.

9 See *Best Practices for Photovoltaic Household Electrification Programs,* World Bank Technical Paper No. 324.

- **Local Adaptation and Production of Technology.** The project team noted the problems reported in India where foreign designs were adapted to local wind regimes and site conditions without adequate product and performance testing. The risks associated with relying on imported equipment were also noted, as sharp cost increases could result in a case of currency devaluation. To address these issues and further cost reduction, the technology improvement component was included to support local production of windfarm and PV equipment. The technology improvement component is based on successful programs for renewable energy technology development in the Netherlands, European Union, the United States and Japan. These programs all incorporate competition and cost-sharing with industry as principles. Key lessons learned are: (a) the importance of clear, quantified and time-bound goals; (b) the need for an active approach to solicitation of proposals; (c) the need for constant dialogue with industries on priorities and targets; and (d) the importance of careful monitoring of results.

4. Indications of borrower commitment and ownership:

The Government and beneficiaries' commitment and sense of ownership are high. China has long supported renewable energy. It recently extended this support to windfarms and PV systems (see Section B.3), with 168 MW of installed windfarm capacity and an estimated 90,000 rural PV systems already in use. The Bank/GOC renewable energy studies provide a solid foundation for the proposed project and a track record of timely completion of activities. Support for the project is strong not only in SETC and SP, but also in other organizations that have been involved in the Leading Group throughout the sector studies and project preparation. Government support for the proposed project is confirmed in a letter from the World Bank Department of MOF (GEF focal point), dated September 1, 1997, that confirmed GOC commitment to the project and requested GEF support.

The PMO has encouraged strong collaboration by provincial authorities and project beneficiaries (see section 7a). Feasibility studies have been prepared for all windfarm sites and PPAs have been developed during project preparation. All 17 PV system companies participating in project preparationhave already prepared and submitted draft business plans to expand their businesses under the project.

5. Value added of Bank and GEF support in this project:

Bank and GEF support would help to accelerate and sustain renewable energy market development in China. The Bank loan would facilitate the funding of the two largest commercial-scale windfarms. ICB procurement is expected to result in substantially lower costs for windfarms than previously experienced in China. In addition to providing financial resources and facilitating competition, the Bank will provide policy expertise and cross-country experience from projects in India, Indonesia, Sri Lanka, Argentina and Lao PDR. Institutional strengthening activities during project preparation are helping to build the capacity of participants to implement the project, funded by GEF and PHRD grants and Trust Funds (see institutional section below).[10]

GEF support has been essential in doing sector work and institutional strengthening prior to the project. It will continue to be essential during the project to overcome institutional barriers, thereby permitting more rapid implementation and penetration of renewable energy technologies. It would also enable in-depth monitoring and evaluation of project impacts.

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10 A GEF PDF Block B grant of $590,000, and a PHRD grant of $433,000 were obtained to support institutional strengthening activities during project preparation.

E: Summary Project Analysis: (detailed assessments are in the project file, see Annex 13)

1. Economic: (supported by Annex 5)

[X] Cost-Benefit Analysis : NPV = see below; ERR = see below [X] Cost Effectiveness Analysis

Cost-Benefit Analysis

Windfarm Component. The economic analysis was carried out by the Beijing Economic Research Institute for Water Resources and Electric Power (BERI), in conjunction with SP and the windfarm companies.[11] The analysis was conducted in two steps: (a) a least-cost study to determine under what conditions windfarms are part of the generation mix; and (b) cost-benefit analysis. In both steps, the analysis was done with and without estimated local and global environmental costs of thermal power development (see Annex 5 for details).

Separate least-cost analyses were done for the Jing-Jin-Tang (JJT) Grid (Huitengxile and Zhangbei), the Fujian Grid (Pingtan), and Shanghai (Chongming Island /Nanhui). The analysis showed that none of the windfarms are part of the least-cost plan if environmental externalities are not considered. However, Huitengxile and Pingtan Windfarms would be selected as part of the least-cost mix if local externalities were incorporated in the costs of thermal power generation; and Zhangbei Windfarm would be selected when both local and global environmental externalities were considered. The Chongming/Nanhui Windfarms are not selected as least-cost alternatives, even with consideration of both local and global externalities.[12] They are included in the project because their location near Shanghai is considered to have value in demonstrating the technology.

A complementary analysis was done assuming a 20 percent premium on the exchange rate (due to trade distortions). The result showed that the Pingtan Windfarm remained part of the least-cost generation mix if only local environmental impacts were considered, while the Huitengxile and Zhangbei Windfarms remained part of the least-cost mix if both local and global impacts were considered. If a 30 percent premium is assumed, only the Pingtan Windfarm remained part of the least-cost mix, if local impacts are considered.

Cost-benefit analyses were conducted to confirm the economic viability of the windfarms. Benefits were estimated as the average tariff paid to generating plans on each system in 1997. This estimate of benefits is more conservative than the willingness-to-pay approach used in analysis of the Bank's thermal power plants in China. This approach was taken to recognize the nondispatchability of the windfarms. The economic internal rate of return (EIRR) was calculated for each windfarm, first without environmental externalities, then with local environmental impacts, and finally with both local and global environmental impacts.

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11 See *Economic Analysis on China Renewable Energy Project: Windfarm Component* (November 1998) in the project files.

12 As part of the least-cost analysis, the average incremental cost (AIC) for expansion of each grid with and without windfarms was calculated without externalities. Because of the small capacity of the windfarms compared to the grid, the increase in AIC with the windfarms is insignificant.

	Huitengxile	Zhangbei	Pingtan	Chongming/Nanhui
Average generation tariff (1998 Yuan/kWh)	0.268	0.268	0.323	0.41
EIRR (%)				
With local and global externalities (base case)	14.1	14.1	13.1	8.4
With local externalities	12.6	12.8	11.6	7.6
No externalities	5.4	5.1	5.9	5.0

The base case EIRR for the total windfarm investment (with both local and global externalities) would decrease to the test discount rate of 12 percent in the case of one of the following occurrences (switching values):

	Huitengxile	Zhangbei	Pingtan	Chongming/Nanhui
Avoided cost or generation decreased (%)	17.1	16.7	7.2	n.a
Cost overrun (%)	11.1	10.8	5.1	n.a
Commissioning delayed (year)	1.0	1.0	0.5	n.a
Exchange rate increase (percent)	15.8	15.3	8.6	n.a

A risk analysis was carried out using Risk Master computer software, which takes into account uncertainties related to the above variables (using the Monte Carlo Simulation). The EIRR for the Huitengxile, Zhangbei and Pingtan Windfarms, based on the weighted average of all simulated combinations ranges from 12 to 13 percent (with a standard deviation of 2.6 to 2.7 percent). The minimum and maximum EIRR, under the considered uncertainties, range from 4 to 5 percent and 21 to 25 percent, respectively. The probability of a negative outcome (negative net present value—NPV) ranges from 34 to 48 percent. This indicates that the risk associated with each windfarm project is high.

PV Component. Least-cost and cost-benefit analyses were not carried out for the PV Component, as the PV systems are being sold in areas where there are no viable alternatives. These are areas of the northwestern provinces of Gansu, Inner Mongolia, Qinghai and Xinjiang, Tibet, western Sichuan and adjacent areas that are distant from existing grids, have good solar resources, large numbers of rural households without electricity, low rural population densities, and a significant population of herdsmen who are seminomadic.

There were over 6,000 villages and an estimated 2.7 million households without electricity in these provinces in 1996. Population densities are the lowest in China, ranging from an average of 0.2 households per square kilometer in Qinghai to 2.3 households per square kilometer in Gansu.[13] Grid extension is generally not feasible because of low population densities and long distances from the existing grid. Gasoline and diesel generators are used mainly for productive purposes, rarely for household use because of the small requirements of individual households, their dispersion and logistical difficulties in supplying fuel and maintenance. While household-scale wind systems are used extensively in Inner Mongolia, wind resources are not adequate in many other locations and are seasonal. On the other hand, PV systems can be purchased by an individual household and require little maintenance. Only PV and PV/wind hybrid systems can provide reliable year-round electricity.

The viability of PV systems for this niche application is demonstrated by the recent rapid expansion of PV system sales in the project areas. The 17 companies participating in project preparation report an expansion in sales from 423 kilowatt peak (kWp) in 1995 (17,600 systems), to 917 kWp in 1997 (44,600 systems), an increase of 117 percent over two years. These companies sell mainly small, portable systems, for cash, to herdsmen families. Current reported annual sales are already equal to over 45 percent of the project's average annual sales target of 2 MW.

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13 Based on an average of 4.5 people per household.

A market study is under way and will be completed by April 1999, to characterize the potential purchasers of PV systems, their energy service demands, willingness to pay and preferred payment patterns.

Incremental Cost Analysis: All Components.

Annex 5 contains an analysis of the environmental incremental costs and benefits of the project. The incremental cost, defined as the difference between the "Baseline" and "GEF" alternatives, is estimated to be $112.6 million. Of this incremental cost, $35 million would be paid by GEF and $77.6 million would be paid by GOC and PV and wind equipment companies.

The incremental costs have been calculated for each component, while the benefits have been calculated for the project as a whole because all components are needed to realize the project goals and development objective. The institutional strengthening and the technology improvement activities support the investment components/activities in order to reach the program objectives of installed capacity, reduced system costs and emission reduction.

No GEF funds are proposed for the windfarm investment activity. GEF funds are proposed to support institutional strengthening that would lead to further windfarm investments, as well as to support investment and institutional strengthening in solar PV and technology improvement, where the funds are expected to have greater long-term impact.

The project is expected to directly displace about 6 million tons of coal equivalent and reduce CO_2 emissions by about 13 million tons over the 20-year life of the project. The direct incremental emission reduction from the project is estimated to be 6.2 million tons CO_2, at a cost to GEF of $5.65 per ton. The total incremental emission reduction, including direct and indirect impacts of the project, is estimated to be 17.2 million tons of CO_2, at a cost to GEF of $2.03 per ton of CO_2.

2. Financial: (see Annex 7)

Windfarm Component

Financial analysis of the windfarm component was conducted by BERI in conjunction with SP and the windfarm companies.[14] The financial internal rate of return (FIRR) for each windfarm is estimated to be 14.1 percent for Huitengxile, 14.0 percent for Zhangbei, 15.5 percent for Pingtan and 16.2 percent for Chongming/Nanhui. These returns are based on estimated prices using "new plant, new price" formula and applying covenants as described below (see Annex 7 for details).

The price for each windfarm will be calculated and approved annually by the appropriate Pricing Bureau. In the financial simulation, an iterative process was followed. The prices were first determined for each windfarm using the formula based on the "new plant, new price" policy. This formula calculates the price as the sum of the following elements: full debt service requirements, O&M costs (including depreciation not used for debt repayment), taxes related to the project and a reasonable profit (estimated as rate of return on funds invested by each windfarm company).

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[14] See *Financial Analysis for the Windfarm Component of the China Renewable Energy Development Project*, BERI, August 26, 1998, revised January 1999, in the project files. This analysis assumed that the estimated foreign exchange requirements not covered by the World Bank Loan (estimated at $44.4 million) would be financed on the same terms as the World Bank loan. Complementary analyses were carried out assuming that the $44.4 million would be financed by local loans and foreign exchange obtained on the "swap market." The results of the complementary analyses showed that prices would be slightly higher during the first seven years, and slightly lower thereafter. The complementary analyses are available in the project files.

Using the calculated prices, financial simulations were carried out for each windfarm. If the two agreed-upon financial covenants were not met in one simulation, the price was gradually increased until full compliance was reached. These covenants were: (a) a debt service coverage ratio of no less than 1.5 at all times; and (b) a rate of return of not less than 10 percent.[15] Using the agreed pricing formula and applying the covenants, the average tariff for each windfarm was estimated as shown below:

Average tariff from 1999 to 2006:

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
fen/kWh (current)	42.2	45.5	70.5	90.0
fen/kWh (1998 Yuan)	34.6	37.4	56.5	72.2

Average tariff from 2007 to 2020:

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
fen/kWh (current)	49.2	52.8	80.5	106.0
fen/kWh (1998 Yuan)	23.9	25.7	38.8	51.0

The tariffs for Huitengxile and Zhangbei are very close to the projected average tariffs from new conventional power plants on the North China grid (e.g., average of 45.8 current fen per kWh for Tuoketuo from 2001 to 2006.)

The base case financial projections on the individual windfarm projects did not explicitly incorporate potential losses from foreign currency fluctuations. While the Renminbi has remained relatively stable in the past vis-à-vis the dollar and other hard currencies, the recent financial crisis in East Asia does underscore a need to take into consideration such issues, at minimum to demonstrate possible negative impacts to consumers in terms of higher tariffs. Adjusting the exchange rate for differences in inflation, using current projections, would result in an increase of 2 to 4 percent in windfarm tariffs by 2008. An additional sensitivity analysis was carried out to investigate the impact of an increase of 10, 20 and 30 percent in the exchange rate on tariffs. The results indicated an increase in average tariffs from 1999 to 2008, in current terms, of about 7, 14 and 21 percent, respectively.

Fiscal Impact: The proposed windfarm investment subcomponent is expected to generate the following tax revenues over the period 1999-2020:

(current million Yuan)	Huitengxile	Zhangbei	Pingtan	Chongming/Nanhui	Total
VAT	507.8	253.0	135.6	158.2	1,054.6
Income Tax	407.2	202.0	118.9	142.6	870.7
Sales Tax	40.6	20.2	10.9	12.7	84.4
Total	955.6	475.2	265.4	313.5	2009.7

NPV (1998 million Yuan)	Huitengxile	Zhangbei	Pingtan	Chongming/Nanhui	Total
VAT	154.1	76.8	39.4	45.5	315.8
Income Tax	114.2	56.7	32.4	38.2	241.5
Sales tax	12.3	6.1	3.2	3.6	25.2
Total	280.6	139.6	75.0	87.3	582.5

PV Component

A financial model has been used to analyze the financial situation of a typical PV system company, and the consolidated picture for total sales under the project, based on the draft business plans from 17 companies. Based on simulations, the return to the companies would average 5 percent on equity and 4

[15] See Annex 7 for details.

percent on net assets, excluding the GEF grant, and 35 and 25 percent, respectively, with the GEF grant, over the five years of the project. While these rates appear high, the intention is to capitalize the companies to enable them to expand their businesses. When the direct grant is removed at the end of the project, it is expected that sales can continue on a sustainable basis as: (a) the sales and service network would be largely in place; (b) module costs, the largest single cost component, are expected to fall about 25 percent in real terms during the project; and (c) if financing mechanisms can be developed, the systems will be affordable to a larger segment of the market.

Fiscal Impact. The proposed investment subcomponent is expected to generate tax revenues that total Y 150 million during the project life, of which Y 133.3 million are VAT, Y 9.3 million are income taxes, and Y 8 million are sales taxes. Based on a discount rate of 12 percent, the NPV of the tax revenues generated by the proposed project is estimated to be Y 96.6 million, of which Y 85.7 million are VAT, Y 5.9 million are income taxes and Y 5.0 million are sales taxes.

3. Technical:

Windfarm Component. Feasibility studies were prepared for each windfarm by the Inner Mongolia, Fujian or Shanghai Electric Power Institutes. TA was provided to ensure that the windfarms have been designed and would be implemented according to internationally accepted technical criteria and standards. Each project includes new on-site substations and/or new transmission facilities to connect the windfarm to the existing grid. The cost estimate of the project is based on the latest international tendering information available for similar procurement and work. Physical contingencies (5 percent for foreign costs and 10 percent for local costs) and price assumptions (based on the Bank's assumptions in October 1998) are adequate.

PV Component. Product quality assurance would be carried out by applying standards and specifications for PV components, as well as developing test procedures and certifying products at testing centers in China. Participating PV companies would be required to meet the standards and to demonstrate adequate quality assurance procedures, as well as setting up service centers with trained staff. TA would be provided to strengthen the capacities of the companies for quality control of products and services. During project implementation, consumer surveys and field audits would assess product performance and consumer satisfaction. Feedback would be provided to suppliers. The capability of the testing centers would be strengthened, and randomly acquired product samples would be tested to assure continued product quality.

Technology Improvement. PV and wind industry surveys were conducted in the preparation of the project. For the development of large-scale turbine (>500 kW), China will need to depend on foreign technology. The TI component for wind energy is expected to focus on technology transfer in the short term. The small PV systems for rural household use (20 Wp), manufactured in China, are about 25 percent cheaper than imported systems. However, quality is a problem. The focus of the TI component for PV will be on quality improvement of components (increasing lifetime and reducing failure rate). This could lead to a small price increase initially, but would result in much lower life-cycle cost.

4. Institutional:

The project would continue efforts initiated during sector work and project preparation to put in place the enabling environment to support market development of windfarms and solar PV (see Annex 4.) During project preparation, the foundation for the project was laid by capacity building to assist local consultants, PMO/SP staff, and staff of the PV and windfarm companies to:

- prepare windfarm feasibility studies to international standards;
- prepare PPAs and other legal documentation for windfarms to international standards;

- prepare standards and specifications, and certification procedures for PV systems;
- prepare PV system company business plans;
- carry out a market survey to determine the characteristics of PV system purchasers;
- understand the Bank's procurement requirements; and
- prepare the PIPs for each component, especially the Technology Improvement Program.

The project would continue institutional strengthening of windfarm and PV system companies, companies involved in technology improvement, and the PMO/SP through the institutional support subcomponents, as described in Section C1.

The agreed procurement and disbursement arrangements are presented in Annex 8.

5. Social:

The project's substantial expected social benefits are detailed in section C3.

Possible negative social impacts of windfarms were investigated as part of the Resettlement Action Plans (RAPs) for each site and were determined to be minimal. The five windfarm projects would (a) require permanent acquisition of about 40 hectares and temporary acquisition of about 62 hectares, and (b) affect 68 persons due to impact from land loss. A more detailed description can be found in Annex 10.

Minimization of the scope of land acquisition was, and would continue to be, a high priority throughout the planning, design and implementation of the proposed project. Where land acquisition is unavoidable, the resettlement plans provide for compensation, services and resources to improve, or at least restore, the living conditions and income of the people affected by the project.

6. Environmental assessment:

Environmental Category [ ] A [X] B [ ] C

In accordance with OD 4.01 (Environmental Assessment), the project has been assigned a Category B status by the World Bank.

This project is considered to have significant environmental benefits. In both the PV and Windfarm components, electricity is generated without damaging emissions of GHG, NO_x SO_2 and TSP. Environmental analysis focused mainly on the windfarms. The analysis concluded that the windfarms would have minimal impacts on land, water, wildlife and human populations.

Environmental Management Plans (EMPs) have been prepared by the Beneficiary of the Bank loan for each windfarm investment project. Although an Environmental Assessment (EA) was not required, environmental analysis was performed for each investment project by the respective provincial electric power design institute as part of the windfarm feasibility studies.

The EMPs and environmental analysis presented in the feasibility studies have been reviewed by the World Bank. It has been concluded that all environmental aspects are satisfactorily addressed and in compliance with all Chinese and World Bank environmental regulations, policies and procedures. The project has been designed and will be implemented in accordance with modern concepts of environmental management. As part of the EMP, a monitoring program (see Annex 10) has been prepared to assure sustained integrity of the mitigation program.

Environmental issues considered in the EMP included:

- During windfarm construction: Noise caused by construction vehicles. Impacts on temporarily acquired lands. Short-term air quality impacts caused by increased dust levels.

- During windfarm operation: Noise caused by the aerodynamic interaction between the wind and turbine blades. Impacts on birds (potential collisions between turbine blades and birds). Interference with communication systems (caused by turbine blades and/or corona noise from electrical transmission and distribution lines). Impact of land acquisition on current inhabitants.

Mitigation measures incorporated into the project design include:

- Construction equipment will only be operated during daytime hours and only on the windfarm site. Windfarm sites have been chosen with consideration of adjacent villages, households, etc. Bidding documents will specify turbines that satisfy international standards for noise.
- All temporarily acquired lands will be returned to their natural conditions. Only access roads (on permanently acquired lands) will be used to service turbines.
- Windfarm sites have been selected with consideration of migratory bird paths and local bird populations. Turbines will be mounted on tubular towers (i.e., not lattice towers) to avoid perching opportunities.
- Electric transmission and distribution lines will be sited to maintain acceptable minimum distances between households, other buildings, etc. Polychlorinated biphenyls (PCBs) are illegal in China and therefore will not be used in the project.
- All dirt roads will be dampened to reduce dust.

7. Participatory approach:

a. Primary beneficiaries and other affected groups:

Project preparation involved all major stakeholders, as well as independent consultants. The PMO organized a series of workshops with power and windfarm companies, PV system companies and equipment manufacturers, as well as provincial authorities. At these meetings, the project concept, design and implementation were discussed and modified significantly. For example, based on discussions with the PV companies, the size of eligible PV systems was lowered to 10 Wp and requirements that the PV companies offer an option of credit payment to customers were dropped. The PV Product Technical Standards were developed by a committee of local experts, assisted by an international expert, and then circulated to local and international companies for comments before being finalized. The Technology Improvement Program was also developed with the guidance of a committee that included representatives of local industries. The outline of the program was presented and discussed at a workshop attended by 139 companies and institutions.

For PV, the team consulted with households and county authorities in Qinghai. In addition, a market study was carried out to help determine the energy service needs and payment preferences of potential PV consumers. As the sample for the market survey was carefully designed to be representative of the target population, the survey will also serve as a baseline for evaluation of project impacts. Focus group interviews were conducted to supplement the survey. These interviews confirmed the high value placed on PV systems by herdsmen households, but also confirmed the inadequate after-sales service available.

b. Other key stakeholders:

International wind turbine equipment suppliers and developers, and PV module manufacturers and service companies have been consulted, especially on project costs and technology upgrading. Of the 139 company representatives that attended the workshop on the Technology Improvement Program, 11 were from international companies.

F: Sustainability and Risks

1. Sustainability:

Long-term sustainability of windfarms and solar PV systems for rural use requires cost reduction and quality improvement, an increase in commercial capabilities, and development of large-scale markets. For windfarms, costs would be reduced by economies of scale, procuring equipment through ICB and promoting domestic production of equipment in technology areas where local manufacturers have a comparative advantage. Assistance would be provided to windfarm companies to strengthen their management of construction and O&M activities. Sustainability of windfarm development is also promoted by assisting GOC in implementing a strategy for diversifying financing of future wind power projects, and by preparing investment packages to attract private investment on one or more large wind power sites.

For solar PV, sustainability would be achieved through: quality improvement and after-sales service, cost reduction and increased affordability through appropriate payment mechanisms. The project would require that suppliers meet quality standards for both products and service. To reduce costs and improve equipment quality, the project relies on strengthened competition among suppliers and technology improvement to support local production of high-quality, low-cost modules and system components.

2. Critical Risks: (reflecting assumptions in the fourth column of Annex 1)

Risk	Risk Rating	Risk Minimization Measure
Annex 1, cell "from Outputs to Objective"		
a) Capacity not installed and maintained according to industry standards.	M	Build capacity of staff of PV and windfarm companies, implement PV standards and specifications, make random audits of PV systems.
b) Windfarm and PV investment costs are not reduced.	S	Support development of low-cost, high-quality local technology, strengthen competition.
c) SETC and other government agencies do not continue to support windfarm and PV development.	M	GOC commitment to wind power and solar PV strong. GOC stated objectives are higher than the project's.
d) Economic reforms do not improve business climate; prolonged downturn in economic growth.	M	Outside project scope. Not expected by CAS.
e) Policy incentives are not implemented.	N	Policies already adopted during project preparation include exemption of duty and VAT on imports of renewable energy equipment and extension of "new plant, new price" for wind power. The project will increase economic competitiveness and publicize environmental advantages of PV and wind.
f) High upfront cost barrier not addressed for PV.	H	Help companies identify mechanisms to increase affordability; assist them to obtain loans so that they can extend credit and leasing arrangements to customers.
g) Insufficient awareness among companies of the importance of technology upgrading.	M	Extensive promotion of the program by PMO, including workshops and training.
Annex 1, cell "from Components to Outputs"		
a) Inadequate wind resources to justify project.	N	Base-case wind resource estimate is conservative. Economic analysis performed to ensure viability under lower than expected wind resources.
b) Power tariff for wind not approved, maintained.	N	Covenant on tariff. Wind power tariff has little impact on average consumer tariffs.
c) Selected PV companies do not perform as expected.	H	Build capacity of companies during preparation and implementation. Monitor performance during implementation, eliminate poor performers and allow new entrants.
d) Failure to build PV consumer confidence.	N	Emerging markets indicate strong consumer interest in PV systems; market survey conducted; standards and certification procedures adopted; company compliance and consumer complaints to be monitored.

Risk	Risk Rating	Risk Minimization Measure
e) Inadequate management of PV component.	M/S	Provide capacity building and technical assistance to PMO and PIUs.
f) Companies do not make good proposals for cost-shared technology upgrading	M/S	PMO will have dedicated staff to actively solicit and assist companies to prepare proposals.
g) Loans for TI follow-up investments do not materialize	M/S	SETC will provide financial assistance to companies on terms that are the same or similar to those for technical retrofitting projects; the TI component will assist companies to prepare bankable proposals, and to submit applications for loans from commercial banks and financial assistance from SETC.
g) Foreign exchange risk	M/H	Government committed to avoid currency fluctuations, TI supports increase of production of high-quality, low-cost local components, where China has comparative advantage.
Overall Risk Rating	S/H	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

3. Possible Controversial Aspects:

None

G: Main Loan Conditions

1. Effectiveness Conditions:

- Execute the subsidiary loan agreement between the Government and SP, acceptable to the Bank.
- Execute the subgrant agreements between the Government and SP, acceptable to the Bank.
- Incorporate the Inner Mongolia Windfarm Company, with the condition that disbursements will be limited to $53 million until all windfarm companies are established.

2. Agreements reached with the State Power Corporation during negotiations:

SP will cause the windfarm companies to undertake the following actions:

- Sign the PPAs prior to December 31, 2000.
- Carry out the environmental management plans for each windfarm as presented in the feasibility studies and in a manner satisfactory to the Bank.
- Carry out the resettlement program for each windfarm as presented in the respective RAP and in a manner satisfactory to the Bank.
- Carry out the organizational restructuring and financial management systems studies of the windfarm companies according to the terms of reference agreed with the Bank, and implement the recommended organizational improvements and accounting and financial management systems, in a manner satisfactory to the Bank.
- All windfarm companies will be established by June 30, 2000.

SP will cause the following financial performance requirements of the windfarm companies to be met:

- Take all necessary measures, including but not limited to tariff adjustments, to earn an annual return of not less than 10 percent of equity (defined in this case as the total unimpaired paid-in capital) beginning with the first full fiscal year of operation for each windfarm until 2006, and on net fixed assets thereafter.
- Take all necessary measures, including but not limited to tariff adjustments, to maintain internal cash generation to provide a debt service coverage ratio of no less than 1.5 for the first full year of operation for each windfarm and annually thereafter during the term the debt is incurred.

SP will cause the following reporting, monitoring, and auditing requirements to be met (see Annex 6 for details):

- Furnish to the Bank, by June 30 of each year, a rolling eight-year financial plan containing projected income statements, funds flow statements, and balance sheets for each windfarm company.
- Maintain and provide the Bank with biannual financial reports, by March 15 and September 15 of each year, including unaudited project accounts for each windfarm company and for the project.
- Furnish the Bank with annual financial statements and audit reports for each windfarm company and for the project within six months of the end of each reporting year.
- Prepare Progress Reports for Project Management and Monitoring that are in accordance with formats agreed during negotiations.

3. Agreements reached with SETC during negotiations:

SETC will meet the following financial and fiscal requirements:

- Make available $50 million equivalent from SETC's Technical Retrofitting Loan Program for loans for PV and wind technology improvement projects that meet the objectives of the project.
- Confirm that PV and TI companies participating in the project receive the benefit that grants from foreign governments and multilateral agencies are not included as income for the purpose of calculating taxable income as allowed under current Chinese tax law.
- Provide information to windfarm companies and PV companies on eligible equipment for exemption from customs duties under current Chinese law.

SETC will meet the following requirements related to the PMO:

- Maintain the PMO for the duration of the project with functions and resources acceptable to the Bank and competent staff in adequate numbers to implement the project.
- The PMO will prepare the first year work plan and budget for the Market Development Program, acceptable to the Bank, prior to disbursement. For subsequent years, the PMO will submit the work plan and budget for approval by the World Bank by October 31 each year, review them with the Bank and finalize by December 31 each year.
- The PMO will prepare the first-year program and invitation-to-bid for the first tranche of Technology Improvement Component grant funds, acceptable to the Bank, prior to disbursement. For the subsequent years, the PMO will submit the annual program and invitation-to-bid for approval by the World Bank by October 31 each year, review them with the Bank and finalize by December 31 each year.
- The PMO will appraise companies applying to participate in the PV and TI components according to the procedures described in the PV and TI Implementation Manuals.

SETC will meet the following reporting, monitoring and auditing requirements (see Annex 6 for details):

- Maintain and provide the Bank with biannual financial management reports by March 15 and September 15 of each year including unaudited statements for the PV and TI Components; and
- Furnish the Bank with audited financial statements for the PV and TI Components within six months of the end of each reporting year.
- For the PV Component, the project audited financial statements should be accompanied by copies of the annual audit reports of all participating companies, as well as a summary report by the PMO on the financial performance of the participating PV Companies.
- Prepare biannual Progress Reports for Project Management and Monitoring[16] by March 15 and September 15 of each year that are in accordance with formats agreed during negotiations.

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16 The monitoring reports will be done biannually initially, but may be required on a quarterly basis if necessary.

H: Readiness for Implementation

[ ] 1. a) The engineering design documents for the first year's activities are complete and ready for the start of project implementation.
[ ] 1. b) Not applicable.

Detailed feasibility studies completed.

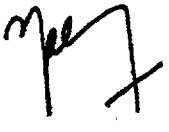
[ ] 2. The procurement documents for the first year's activities are complete and ready for the start of project implementation.

Prequalification documents under preparation.

[X] 3. The Project Implementation Plan has been appraised and found to be realistic and of satisfactory quality.
[ ] 4. The following items are lacking and are discussed under loan conditions (Section G):

I: Compliance with Bank Policies

[X] 1. This project complies with all applicable Bank policies.
[ ] 2. The following exceptions to Bank policies are recommended for approval. The project complies with all other applicable Bank policies.



[signature]
Task Manager: Noureddine Berrah

[signature]
Sector Manager: Yoshihiko Sumi

Annex 1: Project Design Summary

China: Renewable Energy Development Project

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
a. Sector-related CAS Goal: 1. Electricity supply increased in an environmentally sustainable way and access of isolated rural population to electricity services improved. **b. GEF Operational Program:** Promotion of the adoption of renewable energy by removing barriers and reducing implementation costs.	1. Avoided emissions (million tons) 1998 2004 2007 a. CO_2, 7.6 31.4 55.9 b. SO2, ... 0.4 0.7 c. TSP 0.5 1.9 3.3 d. NOx ... 0.1 0.2 2. Installed cost of windfarms ($/kW) 1998 2004 2007 1300 1000 950 3. Installed cost of PV systems ($/Wp) 1998 2004 2007 16 13 11	1. Project implementation reports and sector statistics. 1.2 As above 1.3 As above	(Goal to Bank Mission) 1. Improved environmental awareness.
Project Development Objective: 1. Development of sustainable markets for wind and PV technologies.	1. Generation of wind electricity (GWh) 1998 2004 2007 416 1,505 2,618 2. No. of PV systems sold (000s) 1998 2004 2007 90.0 466 585 3. Installed Capacity (MW) 1998 2004 2007 Wind 168 608 1,058 PV 1.8 11.8 17.6 4. Number of component manufacturers that reach quality standards. 1998 2004 2007 Wind 0 10 20 PV 0 20 30	1.1 Sector statistics 1.2 Sector statistics 1.3 Project monitoring survey 1.4 Project monitoring survey. 1.5 Project monitoring survey.	**(Objective to Goal)** 1. Capacity installed and maintained according to industry standard. 2. Continued support from concerned agencies for wind and PV technologies.
Outputs: 1. 190 MW of windfarms in operation 2. 10 MW of PV systems installed and providing electricity to rural households/ /institutions (300-400,000 systems) 3. Enabling environment for wind power development in place.	1.1 Installed windfarm capacity: a) 100 MW by 2002 b) 190 MW by 2004 2.1 Number of PV systems sold and operating a) 100,000 by 2002 b) 300,000 by 2004 2.2 MW of PV systems sold and operating a) 2 MW by 2002 b) 10 MW by 2004 3.1 30 staff trained in financial management systems; engineering, construction mgt. And O&M mgmt; and private sector development of windfarms by 2001. 3.2 Preparation of private-sector investment packages for 200 MW by 2001. 3.3 Promotion of packages to investors carried out by 2003.	1. 1 Semiannual implementation reports and 590s. 2.1 As above. 3.1 Project documentation and semiannual implementation reports, supervision/590s.	**(Outputs to Objective)** 1. Construction carried out according to industry standards. 2. Lower investment costs due to competition and economies of scale. 3. SETC and other government agencies continue to support wind and PV development. 4. Economic reforms would improve business orientation of state-owned (and quasi-state owned) PV enterprises and business climate for small/private enterprise. 5. Policy incentives are implemented. 6. High quality standards established and accepted. 7. Marketing strategies improved.

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
4. Enabling environment for PV development in place.	4.1 Quality control mechanisms in place at PV sales companies by 2004. 4.2 3 Capabilities of 3 accredited PV testing institutes strengthened to international standards by 2001. 4.3 Modified project PV system standards adopted as National PV system standards by 2001.	4.1 As above.	8. High upfront cost barrier addressed. 9. Technology improvement component leads to awareness of an investment in technology innovation.
5. Enabling environment for technology improvement in place	5.1 Number of cost-shared projects for technology improvement carried out. a) 250 by 2002 b) 500 by 2004 5.2 Contract targets met in 80% of contracts. 5.3 $50 million loans for technology improvement projects in place.	5.1 As above	
Project Components/ Subcomponents: (see Annex 3 for project description)	**Inputs: (budget for each component)**		**(Components to Outputs)**
A. Windfarm Component 1. Investment 2. Institutional Strengthening	$208.7 million $202.7 million $6.0 million		1. Inadequate wind resources. 2. Power tariff high enough for cost recovery.
B. Solar PV System Component 1. Investment 2. Market Development Program 3. Institutional Strengthening	$155.9 million 144.9 million $7.0 million $4.0 million		3. Selected PV companies perform as expected, offer satisfactory products, sales and service.
C. Technology Improvement Component 1. Grant-assisted Investments 2. Loan assisted Investments 3. Institutional strengthening	$79.6 million $18.0 million $60.0 million $1.6 million		4. Consumers accept PV systems and services. 5. PMO adequately managed. 6. Local equipment companies present good cost-shared proposals for technology upgrading. 7. Local equipment manufacturers have access to loans for TI investment. 8. No significant change in foreign exchange rate.

Key Performance Indicators and Monitoring and Evaluation Procedures

The key indicators of success are defined in the Project Design Summary to include quantity of electricity produced from windfarms, installed capacity of windfarms and rural PV systems, and cost per kW of installed capacity of windfarms and rural PV systems. Targets are defined for these indicators as a measure of barrier removal for commercialization of windfarms and PV technology. As monitoring and evaluation are an essential part of implementation of the PV and Technology Improvement Components, procedures to document these key indicators and other more detailed indicators are defined in detail in the PIP of these components. For all components, these procedures are summarized below. Four entities are involved in the monitoring and evaluation process for the project: SP and the PMO of SETC (the implementing agencies); the World Bank supervision team; the mid-term review team (if required); and Implementation Completion Report (ICR) Consultants. Each of these entities will assess the effectiveness of project implementation, and make recommendations to improve implementation.

The most critical element in the monitoring process will be routine data collection by SP and the PMO. In addition, SP and the PMO will carry out studies and surveys to collect specific information that cannot be obtained from routine activities. The World Bank supervision team will use the data provided by the Implementation Agency as summarized in their biannual reports to assess progress during their semiannual progress reviews. If the information provided is not clear, the World Bank supervision team will review the unedited data maintained by SP and the PMO. When needed, the World Bank supervision team can request the Implementing Agencies to recheck or collect addition data.

Both the mid-term review team and the ICR consultants at the end of the project will review the information collected by SP and the PMO and, when necessary, verify the provided information or collect additional information through specific studies.

Monitoring during Project Implementation

Obtaining Data on Key Indicators. The method of obtaining the actual values of each of the key indicators is detailed below.

The values of the *avoided emissions* will be calculated from the production of electricity from wind as reported by the windfarm companies to SP (kWh) and the sales of rural PV systems as reported by the PV system companies and verified by the PMO (Wp), using the same algorithm as used for the targets (available in the project file). These values will be calculated and included in the biannual reports.

The *generation of wind electricity (GWh)* and *installed wind capacity (MW)* in China comprise electricity generated and capacity installed both as a direct result of the project and outside the project. The electricity generated and capacity from the windfarms developed under the project will be recorded, reported to SP, and included in the biannual progress reports. Data on the electricity generated and capacity from wind turbines installed outside the project will be collected by SP through direct contacts with the windfarm owners and operators. If incomplete information is obtained, SP will estimate the wind electricity generated and installed wind generating capacity.

Monitoring of the *number and capacity (MW) of rural PV systems sold* under the project will be automatic, as this information must be supplied by the PV system companies and verified by the PMO in order to authorize payment of the grant. Data on the number and capacity of systems sold will be compiled by the PMO and included in the biannual reports.[1] Information on the number of systems sold outside the project will be collected from sample surveys conducted by the PMO and funded from the PV Market Development Program budget. These surveys will in principle be conducted once every year.

To verify product quality (that the systems meet project specifications), the PMO will cross-check serial numbers of modules as reported by the PV system company against those reported on shipping documents of modules from qualified module suppliers. The PMO will also maintain on file the certificates for qualified components other than the module. To verify the use of qualified components and that the sale has taken place, the PMO will maintain a database with the customer's name, address and module serial number for each system sold and will commission periodic random audits of sales to customers. Finally, the PMO will obtain the audited annual statements of each participating company , and will commission special audits into the accounts of specific company if required for any reason such as suspected fraud.

The *installed cost of windfarms ($/kW)* of the five windfarms developed under the project and the cost breakdown (turbine, tower, etc.) will be reported by the windfarm companies to SP, and included in SP's

1 Reports will be required biannually initially, but may be required on a quarterly basis if necessary.

biannual reports. Cost information on windfarms outside the project will be collected and reported by SP, which will obtain this data from formal surveys, informal contacts and specialized publications.

Information on *installed cost of PV systems ($/Wp)* under the project will be obtained by the PMO through its PV market monitoring activities under the PV Market Development Program activities, by formal and informal surveys. Information on the breakdown of the cost of PV systems by cost components will be obtained from annual surveys to be conducted under the program support facility under the Technology Improvement Component. The PMO will include these data in its biannual reports.

The *number of component manufacturers that reach project quality standards* will be compiled by the PMO and included in its biannual reports. For PV equipment, the PMO will maintain a regularly updated list of PV component suppliers in China that meet the project's quality standards, in order to ensure that only qualified systems are sold by PV system companies participating in the project. The PMO will conduct surveys to determine the number of local manufacturers that are supplying major components to reputable international wind turbine suppliers within or outside of China.

Information on the *other indicators* listed in the table, such as the number of people trained in specific areas, will be included in the biannual reports prepared by SP and the PMO and in the Implementation Completion report (ICR). The information will be collected and/or compiled by SP and the PMO.

Obtaining Detailed Monitoring Data. In addition to key indicators, more detailed information is required for monitoring specific aspects of project implementation. This detailed information or project statistical information will help the PMO and SP to monitor the progress of implementation and compare actual with projected achievements. It will also help the World Bank in the assessment of the progress of the project. The statistical information that the PMO and SP will be required to collect and maintain is detailed in the PIP for each component. An example is data on the financial performance of the PV and windfarm companies participating in the project, such as the ratios of net income to assets and net income to equity. Another example is information on customer complaints about each participating PV company's systems and after-sales service, which will be tracked carefully.

The detailed information would come from routine project management for the different components. Only a limited amount of information needs to be collected specifically for monitoring and reporting purposes.

Monitoring and Evaluation Costs. For the PV and TI components, monitoring project implementation will be a large part of the task of project management. For the PV Component, such activities include monitoring the PV market, verification of PV sales and field audits of PV sales, at an estimated cost of about $400,000. For the TI Component, monitoring costs are also significant at $145,000. The resources required for collecting the information related to wind have not been included in the project cost. These cost are part of the project management cost that SP will incur. The monitoring costs of this component are estimated at $20,000, as the task is simpler than for the other components.

Monitoring Methods After Project Completion

After project completion, SP and the PMO together with ICR consultants will evaluate the final indicators and the project's market development and CO_2 avoidance impact. The implementing agencies, SP and SETC, are expected to continue to maintain data on essential key indicators such as installed capacity of windfarms and PV systems, as well as number and capacity of companies manufacturing equipment.

In addition, assuming that resources are made available by GEF or another source, the World Bank will field an evaluation mission to evaluate the long-term impacts of the China Renewable Energy

Development Project in 2008. This evaluation mission will estimate and evaluate at least the following information:

- Electricity generated by wind (kWh);
- Installed wind capacity (MW);
- Installed cost of windfarms ($/kW);
- Number of wind component manufacturers reaching acceptable quality standards (number);
- Number of PV systems installed (number);
- Installed capacity of PV (MWp);
- Installed cost of PV systems ($/Wp); and
- Number of PV component manufacturers reaching national quality standards (number).

The required information will be collected through interviews, analysis of national statistics and specific studies.

Annex 2: Project Description

China: Renewable Energy Development Project

The project aims at development of sustainable markets for wind and PV technologies, in order to increase supply of electricity in an environmentally sustainable way and to improve access of isolated rural populations to electricity services. The project focuses on windfarms and PV for rural applications, because sector studies showed these technologies had large near-term potential. For both windfarms and PV, the project focuses on extending markets and reducing costs through economies of scale, increasing competition and technology improvement. The project will achieve these objectives through three components: (a) Windfarms; (b) PV; and (c) Technology Improvement. Each component is summarized below.

Under the Windfarm Component, the State Power Corporation (SP), together with provincial/local power companies, will install and operate 190 MW of commercial-scale windfarms on five sites in four provinces including two large windfarms of 50 MW and 100 MW. The project also includes institutional strengthening activities to encourage future private-sector windfarm investments by (a) strengthening the commercial development capacity of local windfarm companies and SP; (b) developing a strategy to facilitate private-sector windfarm investment; and (c) assisting SP in preparing investment packages for development of more than 200 MW of new windfarms on one or more high-potential sites and promoting these packages to potential investors. Through these activities, the project will contribute to GOC's goal of installing 1,000 MW of windfarm capacity, and create the conditions for windfarms to be fully commercially viable.

Under the PV Component, the State Economic and Trade Commission (SETC) will provide direct grant assistance and institutional strengthening to local PV system companies to sell, install and maintain 10 MW of rural, off-grid PV systems. These systems would be sold to households and institutions in remote rural areas of China's northwestern provinces. PV markets are emerging and developing rapidly in these areas. However, quality problems and poor marketing practices are threatening long-term development and sustainability of these markets. The project will require participating companies to meet project standards for equipment and service, in order to qualify for a grant of $1.50 per Wp sold for eligible units of 10 Wp or greater. In addition, the project has a strong institutional development component to support market development activities and product quality assurance by component manufacturers and PV system companies, and to obtain feedback on consumer satisfaction. The project will contribute to the development of commercially sustainable businesses, including those privately and collectively owned, for sale and service of rural PV systems. These businesses would be able to operate without external support by the end of the project.

Under the Technology Improvement Component, SETC will support the broader and longer-term development of these two technologies by encouraging technology innovation by manufacturers to produce high-quality and low-cost PV and wind equipment components. Grants will be provided to companies, on a competitive basis, to cost-share projects in wind and PV technology improvement, aimed at utilizing China's comparative advantages in manufacturing. Companies will be assisted to obtain loans for follow-up investments. The component is modeled on successful programs in the United States, the Netherlands and European Union. While some overlap is expected, companies participating in the first two components will not be required to participate in this component.

Each component is described in detail below.

A. WINDFARM DEVELOPMENT COMPONENT ($208.7 MILLION)

Overview

China has vast wind resources in terms of wind speed as well as geographic distribution, with a total estimated *technical* potential of 160 GW (this compares to an estimated *exploitable* potential of 56 GW for small hydro). Wind resources are concentrated along a northern belt stretching from Xinjiang in the west to Inner Mongolia in the east, as well as along the coastal region lying on the East and South China Seas (from Shandong in the north to Hainan in the south). These areas include a number of sites with potential resources that can support several hundred megawatts of grid-connected windfarms (e.g., sites in Huitengxile, Inner Mongolia and Dabacheng, Xinjiang each have the potential for supporting 1,000 MW; Hedingshang, Zhejiang has a potential capacity of 750 MW).

Until recently, the wind power resource has been exploited primarily on a piecemeal basis, through small bilaterally financed projects. As of December 1997, there were 50 separately financed grid-connected wind power projects in China representing over 179 MW of capacity. In general, the projects have been implemented by provincial power companies and/or their subsidiary wind power companies. Over 40 of the projects have been financed by bilateral institutions such as DANIDA, KfW, and the United States Import-Export Bank. With an average capacity of 3.6 MW per windfarm, these projects have been useful to familiarize Chinese operators with the technology but have been unable to take advantage of optimized and least-cost development associated with economies of scale and competitive procurement.

The Windfarm Development Component of the China Renewable Energy Development Project builds upon China's experience with existing windfarm projects. The Project seeks to reduce the cost of grid-connected windfarm projects in China by promoting (a) larger projects including 100 MW and 50 MW projects in Huitengxile and Zhangbei, respectively, and (b) increased competition for turbine supply contracts. The Project also provides a foundation for future private-sector involvement in China's wind power sector. The proposed windfarms will be developed by limited-liability windfarm companies (owned by SP and the respective provincial/municipal utility companies) established under GOC's Company Law. The windfarm companies will be financially and managerially autonomous from their parent companies and will sell electricity to the respective provincial utility under internationally acceptable power purchase agreements (PPAs) developed under the Project. SP brings to the project its powerful organization, technical capabilities, financial strength and demonstrated commitment to wind power development.

Beyond these initial steps for promoting private-sector involvement, the Project includes grant funds for TA activities, including preparing windfarm investment packages for one or more sites, each with the potential for supporting several hundred megawatts. The investment packages will include feasibility analysis, tender packages, and supporting legal documentation including PPAs. The investment packages will be introduced and discussed with potential investors at meetings with industry in China and/or abroad. A more detailed description of this and other institutional strengthening and investment activities is given below.

Investment—Windfarm Development Component ($202.7 million)

The Windfarm Development Component covers the design, supply and construction of 190 MW of grid-connected windfarms at five sites in four provinces:

- Huitengxile, Inner Mongolia (100 MW);
- Zhangbei, Hebei Province (50 MW);
- Pingtan, Fujian Province (20 MW); and
- Nanhui and Chongming Island, Shanghai Municipality (20 MW).

Feasibility studies for each of the windfarms were completed and submitted for GOC approval in August 1998. The feasibility studies (see Project files) provide detailed information on wind resources, climate specifications, electrical layout and design, geology/soil conditions, civil works, environmental impacts, energy production estimates, and detailed costs. Schedules for developing each windfarm as well as a summary technical descriptions of the sites, wind resources, energy production estimates, turbine selection, and electrical design are presented below.

The windfarms will be developed by four windfarm companies. Each company will be jointly owned by SP and the provincial/municipal power companies. The ownership structure of each company is as follows:

- Huitengxile—SP (51 percent) and Inner Mongolia Electric Power Company (49 percent)
- Zhangbei—SP (33 percent) and North China Electric Power Company (67 percent)
- Pingtan—SP (33 percent) and Fujian Electric Power Company (67 percent)
- Nanhui and Chongming Island—SP (33 percent) and Shanghai Municipal Electric Power Company (67 percent).

The companies will be formed under the GOC Company Law. The companies will be responsible for detailed engineering, construction management, commissioning and O&M. Each company will be headed by a general manager and assisted by one chief engineer and one chief accountant as well as other supporting staff.

Table 1 summarizes the technical characteristics of each project as well as each project's development schedule. All annual average wind speeds are based on on-site measurements adjusted for long-term average wind speeds (as recorded at local meteorological stations) and variation of wind speeds over the project site (as estimated by the Wind Atlas Analysis and Application Program [WASP] developed by RISO National Laboratory in Denmark). In all cases, a conservative approach to estimating the wind resources has been employed. The table indicates the number of turbines for each windfarm as well as the generating capacity of individual turbines as presented in the feasibility studies. The actual number of turbines and individual turbine generating capacity will be determined through ICB procedures consistent with the Bank's Procurement Guidelines.

Each windfarm site is described below:

- *Huitengxile Windfarm, Inner Mongolia Autonomous Region.* The proposed 100 MW windfarm at Huitengxile is located approximately 120 km east-northeast of Hohhot and 60 km west-northwest of Jining. The windfarm would occupy approximately 21 km^2 of a 42 km^2 site for which the Inner Mongolia Electric Power Company (IMEPC) has received rights to develop such facilities. The long-term annual average wind speed is estimated at 8.6 m/s at an elevation of 40 meters above ground level. Site elevation is approximately 2,100 meters above sea level. The site consists of slightly rolling hills of grassland primarily used for grazing. The annual average temperature at the site is 2.3°C. The low temperatures experienced at the site during the winter months would necessitate a turbine designed for cold-weather use. Approximately 25 MW has already been developed at the Huitengxile site with an additional 5.5 MW under construction. The site is estimated to have a total potential of up to 1,000 MW.
- *Zhangbei Windfarm, Hebei Province.* The proposed windfarm site is approximately 35 km north of Zhangjiakou and adjacent to deteriorated portions of the Great Wall. The latitude and longitude coordinates of the center of the proposed windfarm are 41° 02' north and 114° 45' east, respectively. The long-term annual average wind speed is estimated at 8.4 m/s at an elevation of 40 meters above ground level. Site elevation is approximately 1,600 meters above sea level. The annual mean temperature at the site is 3.3°C. As in Huitengxile, the low temperatures would necessitate a turbine designed for use in cold weather. The site is located on a slightly mountainous topography with a mixture of smooth and rocky slopes and is considered a relatively complicated terrain for a windfarm

site (i.e., wind speeds can vary significantly over the site). Portions of the proposed windfarm site are used for raising crops while others are uncultivated, but contain small shrubs and/or weeds. There are few buildings on the site. The North China Power Grid Company has received rights to develop windfarms on approximately 60 km^2 at the Zhangbei site; the proposed 50 MW windfarm would occupy portions of a 7 km^2 plot. Presently, there are 6 MW of wind turbines on the Zhangbei site. Total potential at this site is estimated at 500 MW.

- *Pingtan Windfarm, Fujian Province.* The proposed 20 MW windfarm site in Pingtan County is located on Haitan Island, a 251 km^2 island located approximately 3 km off the Fujian coast in the Straits of Taiwan. The island is located approximately 128 km southeast of Fuzhou, the capital of Fujian Province. The latitude and longitude coordinates of the proposed site are 25° 31' north and 119° 47' east, respectively. Long-term data indicate that wind speeds at the site to be 9.1 m/s at a height of 50 meters above ground level. The proposed site is near sea level. The annual average temperature at the site is 19.5°C. The climate is generally humid and the salty ambient environment would necessitate special anticorrosion protection for the windfarm equipment. The proposed windfarm would permanently occupy approximately 6,000 m^2 of a 20 km^2 isthmus connecting two coves in the southwest-northeast direction. Mountainous terrain borders the site on both the northwest and southeast sides. The terrain is flat with sandy soil conditions and is covered by nonindigenous limited-growth pines (maximum height of 5 meters) introduced in the 1950s to minimize erosion caused by high-speed winds. There are limited residential buildings on the 20 km^2 isthmus, with no structures located on the proposed windfarm site. Plans are already under way to develop an additional 100 MW at this site.
- *Nanhui Windfarm, Shanghai Municipality.* The proposed Nanhui windfarm is located on the eastern shore of Shanghai Municipality approximately 60 km southeast of downtown Shanghai. Its geographical coordinates are 121° 53' east and 31° 00' north. The long-term annual average wind speed at a 50-meter height above ground level is been estimated to be 7.5 m/s. The coastal area at Nanhui, including the area immediately east of the proposed windfarm, is subject to silt deposits as the Yangtze River empties into the East China Sea, approximately 50 km to the north. As the shore elevates to a certain level, dikes are constructed to assist with land reclamation. As a result, there are a series of parallel dikes, each running in the north-south direction and spaced approximately 5 km apart. The Nanhui windfarm is proposed to be constructed along the easternmost dike. The windfarm, including roads and other areas between turbines, would permanently occupy approximately 6,000 m^2. Land in the surrounding areas is flat with reclaimed land being used for agricultural purposes; there are few building in the immediate area. The annual average temperature is approximately 15°C. The salty and moist ambient air conditions would necessitate the provision of anticorrosion protection for the wind turbines.
- *Chongming Windfarm, Shanghai Municipality.* The proposed windfarm site is located on the eastern shore of Chongming Island, an island of over 700 km^2 located in the mouth of the Yangtze River. The longitude and latitude position of the site is 121° 56' east and 31° 31' north, respectively. The wind speeds are similar to that at Nanhui. The eastern tip of the island, including the area just east of the proposed windfarm, is subject to continual land reclamation as silt from the Yangtze deposits on the eastern shore. As a result, the site elevation is near sea level and the land is flat. Reclaimed land is used primarily for crop raising and some grazing activities. There are few buildings in the area and none on the proposed windfarm site. The windfarm is expected to be built along dikes constructed to reclaim land. Turbine foundations, transformers, roads, and other areas surrounding the turbines would permanently occupy approximately 44,000 m^2. The salty and moist ambient air conditions would necessitate the provision of anticorrosion protection for the windfarm. The annual average temperatures at Chongming is approximately 15°C.

Table 1: Summary Schedule for Windfarm Development

	Huitengxile, Inner Mongolia /a	Zhangbei, Hebei Province /b	Pingtan County, Fujian Province	Chongming Island/Nanhui, Shanghai
Capacity (assumed number of turbines x turbine unit capacity) /c	100 MW (167 x 600 kW)	50 MW (83 x 600 kW)	20 MW (32 x 600 kW)	20 MW (34 x 600)
Total Cost (excluding IDC)	US$99.7 million	US$49.7 million	US$21.6 million	US$27.0 million
Geographical coordinates	41° 09' north 112 32' east	41° 02' north 114° 45' east	25° 31' north 119° 47' east	31° 31' north/31° 00' north 121° 56' east/121° 53' east
Elevation (meters above sea level)	2100	1600	Sea level	sea level
Annual average temperature	2.3°C	3.3°C	19.5°C	15°C/15°C
Existing wind turbine generating capacity on site	25 MW (additional 5.5 MW under construction)	6 MW	-	-
Annual average wind speed (height above ground level)	8.6 m/s (40 m)	8.4 m/s (40 m)	9.1 m/s (50 m)	7.5 m/s (50 m)/7.5 m/s (50 m)
Annual average generation (capacity factor)	302 GWh/yr (34.5%)	139 GWh/yr (31.7%)	53.1 GWh/yr (30.3%)	44.6 GWh/yr (25.5%)
Turbine step-up transformers	• 1 per turbine • 84 x 0.69/10 kV • 83 x 0.69/35 kV	• 1 per turbine • 83 x 0.69/10 kV	• 1 per 4 turbines • 8 x 0.69/35 kV	• 1 per turbine/1 per turbine • 34 x 0.69/10 kV
Substation	• 10/35/110 kV • 3 x 40 MVA	• 10/110 kV • 1 x 63 MVA	• 35/110 kV • 1 x 31.5 MVA	• 10/35 kV/10/35 kV
Turbine supply contract signing	April 2000	April 2000	April 2000	April 2000/February 2000
Foundation excavation	May – Oct. 2000	May - Oct. 2000	July 2000	July 2000/July 2000
Acceptance testing	• April 2001 (first 50 MW) • November 2001 (second 50 MW)	• April 2001 (first 25 MW) • November 2001 (second 25 MW)	January 2001	January 2001/January 2001
Commercial operation	• June 2001 (first 50 MW) • January 2002 (second 50 MW)	• June 2001 (first 25 MW) • January 2002 (second 25 MW)	March 2001	March 2001/March 2001

/a The Huitengxile site is estimated to have potential for supporting up to 1000 MW of Windfarms.
/b The Zhangbei site is estimated to have potential for supporting up to 500 MW of Windfarms.
/c Number of turbines and individual turbine generating capacity as assumed in the windfarm feasibility studies. The actual number of turbines and individual wind turbine generating capacity for each windfarm will be determined through international competitive bidding (ICB) procedures consistent with the Bank's Procurement Guidelines.

Institutional Strengthening—Windfarm Development Component ($6 million)

The Windfarm Development Component also includes institutional strengthening activities designed to increase the sustainability of wind power development in China by (a) assisting with private-sector development of future windfarm projects in China; (b) strengthening the organizational structure and financial management systems of the windfarm companies; (c) ensuring efficient construction management as well as O&M management of the Component's windfarm investments; (d) collecting, evaluating, and disseminating technical and financial performance data on all windfarm projects in China (including those supported by the Project); and (e) supporting training to build the technical, financial, and operational capacity of the windfarm companies. Each activity is further discussed below. Terms of reference for each activity appear in the Project files.

Private Sector Development of Windfarms in China ($3.6 million: GEF $1.8 million). SP has established the goal of developing 1,000 MW of grid-connected windfarms by 2000 and 3,000 MW by 2010 (though achievement of the year 2000 objective is very unlikely). At an assumed installed capital cost of $1,000/kW, the financial resources required to meet these targets exceed $830 million by 2000 and $2.8 billion by 2010. Such requirements greatly exceed the financial resources of traditional financing sources for windfarm projects in China, including GOC as well as bilateral and multilateral development agencies. This activity would support consultants who would assist SP in:

- developing a strategy for private-sector development of windfarm projects in China with due consideration of China's wind power development goals, the status of wind power development in China and abroad, and the GOC approach to diversifying financing for conventional power projects;

- preparation of investment packages for one or two large windfarm sites (several hundred megawatts each), including development schedules; studies (wind resource monitoring, wind resource analysis, feasibility studies, environmental studies, etc.); legal, contractual and commercial documentation; presentation of the packages to potential investors and lenders; and assistance in developing and releasing bid documents, bid evaluation, and contract negotiation in order to come to closure on financing of these packages; and
- providing training on private-sector windfarm development to SP, the windfarm companies under this component and other likely local investors. The training would emphasize the technical, legal, contractual and financial requirements of windfarm developers and would include the participation of banks and other lenders, developers, legal experts, accounting firms and turnkey contractors.

Organizational Structure and Financial Management Systems ($1 million: GEF $0.5 million). This activity would assist the to-be-created windfarm companies in (a) establishing proper organizational structures, (b) developing adequate management practices, and (c) developing adequate financial management systems. This activity would support consultants to carry out the following tasks:

- a comprehensive review of the organizational structure, management practices, and financial/ accounting practices and reporting systems of each windfarm company;
- development of suitable organizational structures and design of the required accounting, financial, and budgeting systems; and
- TA and training to implement the organizational structure and financial management systems.

Engineering, Construction Management, and O&M Management ($700,000: GEF $350,000). Each of the investment projects under this component would be the largest windfarm facilities in the respective jurisdictions. Furthermore, the projects would be implemented by newly formed limited-liability windfarm companies, which would procure the windfarms under a "packages" approach in which various goods and services are procured separately; a turnkey approach would not be used. This activity would support engineering consultants to provide training and assist the windfarm companies in establishing procedures for and carrying out engineering, construction management, and O&M activities. The consultants would:

- review detailed engineering, designs, drawings, and specifications;
- provide training and assist the windfarms companies in all aspects of construction management including scheduling and coordination, procurement, quality assurance/control, equipment management, interface coordination, progress/status reporting, and information and document control; and
- provide training and assist the windfarm companies in all aspects of O&M management including maintaining an on-site stock of spare parts and tools, evaluating performance of individual turbines as well as the windfarm as a whole, designing preventative and maintenance efficiency programs, and scheduling maintenance activities.

Collection, Analysis, and Dissemination of Performance Data ($300,000: GEF $150,000). Windfarm projects in China presently have incremental financial life-cycle costs higher than conventional power facilities operating under similar pricing policies. In order to gauge the effectiveness of the present pricing policy as well as potential future pricing policies and financial incentives, GOC would require technical and financial performance data of China's windfarm projects. Such information would also support the GOC intentions to develop strategies for diversifying the financing and equity sources of future windfarm projects; prospective investors and lenders would require information on the status of windfarm technology and projects in China in order to establish performance credibility. Under this activity consultants would be hired to:

- gather technical and financial information from the developers of existing and planned windfarms in China;

- evaluate the collected data to highlight performance, cost and development trends; and
- prepare and disseminate an annual report that presents the status of wind power development in China.

Funds to Address Identified Training Needs ($400,000: GEF $20[illegible],000). Specific training activities would be formulated by SP in conjunction with Bank staff during supervision missions and would be approved by the Bank. The training would build the managerial, financial, technical and/or operational capabilities of the windfarm companies, SP and/or other stakeholders and would foster the sustainability of wind power development in China. Training activities may be investment specific (e.g., similar to the Engineering, Construction Management, and O&M Management activity listed above) or more oriented to broader sectoral and policy related objectives.

B. SOLAR PV MARKET DEVELOPMENT COMPONENT ($155.9 MILLION)

Overview

The component will support further development and strengthening of emerging PV system markets and companies through the installation of about 10 MW of higher-quality PV and PV/wind hybrid systems and promotion of adequate after-sales practices.[1] PV system companies would market, sell, and maintain about 350,000 systems, in sparsely populated and remote areas of Qinghai, Gansu, Inner Mongolia, Xinjiang, Tibet, Western Sichuan and adjacent areas. The project would help create the necessary conditions for a sustainable market by: (a) providing direct grants to PV system companies ($/Wp basis) to enable them to extend sales and service networks, improve product and service quality, and strengthen their financial and business capabilities; (b) supporting other activities to develop the market; and (c) strengthening institutional capacity for product quality assurance and project implementation.

The project's approach would be flexible and responsive to market signals. Companies would select the market segment they want to serve. In the early years, cash sales of the smaller systems would continue to dominate the market. The demand for larger systems by the more affluent consumers and the smaller systems by the less affluent consumers would grow as: (a) consumer confidence and awareness of the products grows, (b) consumer ability to pay increases due to economic development and evolution of credit markets; and (c) costs come down due to economies of scale in production and sales.

The Solar PV Market Development Component would achieve the above objectives through three subcomponents: (a) Investment; (b) Market Development Program; and (c) Institutional Strengthening.

Investment Subcomponent ($145 Million: $15 Million GEF Grant)

The sales of PV systems to rural consumers would be undertaken by commercial PV companies. These are made up of private enterprises (both shareholding and employee-owned), joint ventures with foreign companies and companies wholly or partially owned by research institutes or state-owned enterprises. The companies would procure systems or components, assemble, install and maintain systems, and enter into sales contracts with their customers. Companies would receive a direct grant of $1.50 per Wp of PV, for each system sold, with a capacity equal to or greater than 10 Wp.

Seventeen companies have been preselected to receive assistance to help them prepare business plans. (The company preselection report is available in the Project Files). Of these companies, four are from Gansu, two from Inner Mongolia, six from Qinghai, four from Xinjiang and one from Beijing. With respect to ownership, eight were state-owned, seven were privately owned and two mixed. They ranged

[1] For descriptive simplicity, PV stand-alone and PV/wind hybrid systems are referred to generally as PV systems.

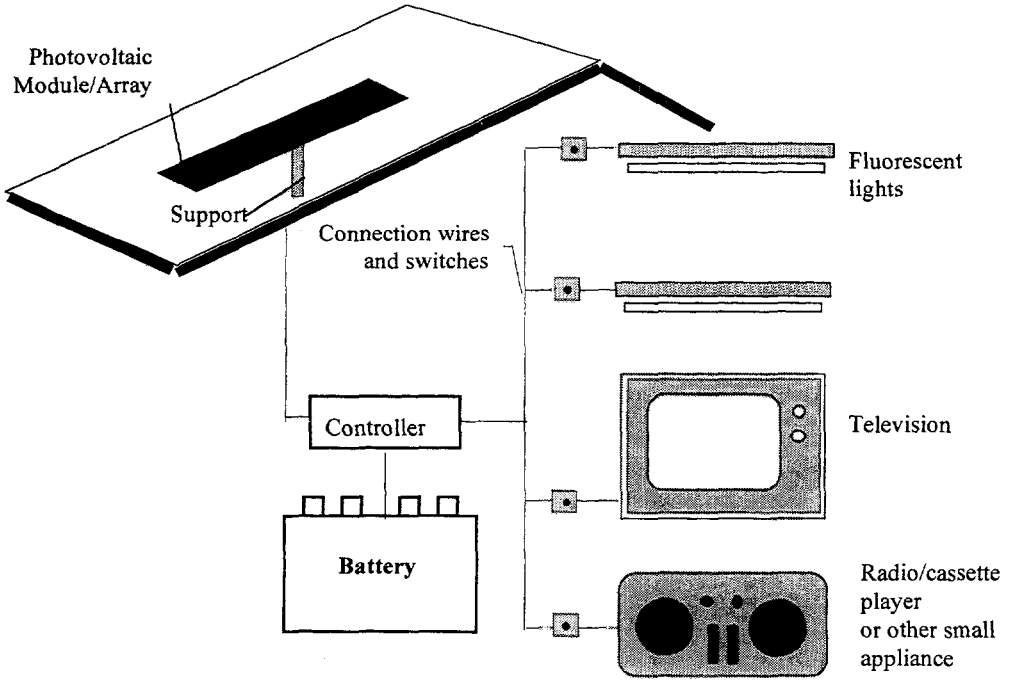
from small PV system companies now selling systems to rural households to a large company selling satellite receivers in rural China. The preselection process was as inclusive as possible to give the maximum number of companies the opportunity to benefit. There will be opportunities for new companies to participate in the future, if they meet participation criteria.

To be selected to participate in the project, a company must demonstrate that it would: (a) offer a comprehensive consumer protection package, including warranties and adequate after-sales service; (b) use certified equipment and components (see specifications below); (c) agree to abide by a company conduct code for good customer service; (d) agree to establish an escrow account, based on the GEF direct grant due to the company, to be used to assist customers with serious complaints against the company; and (e) provide the operational and financial information required by the PMO for project monitoring and evaluation. While 17 companies were preselected to receive assistance, not all companies may meet the conditions for participating in the project. However, during project preparation, these companies showed higher-than-expected commitment to the project objectives by meeting all preliminary requirements in a timely manner. Participation will continue to be open to any company that can meet the above requirements.

Eligible PV Products. The participating PV companies would offer a variety of PV systems to consumers. Examples include a 10Wp PV system providing about 3 hours of lighting services and a PV/wind hybrid system which may consist of a 200 Wp PV array coupled with a 300 W wind turbine. This large system could provide substantial services such as 5-8 hours/day of lighting for up to four lights, and power for color television, radio and refrigerator.

Typical PV System Configurations. A PV system consists of one or more PV modules, a lead-acid battery, a means to control battery charge/discharge, fluorescent light(s) and related components such as wiring, switches and mounting hardware (Figure 1). A PV/wind hybrid system would include a wind generator, typically 300 W or less, and a wind charge controller in addition to the PV system components mentioned above. In China, portable PV systems of 10-20 Wp are the most popular units today. These units are packaged in two sturdy self-contained wooden boxes with carrying handles. one box contains the module, the other contains the battery, controller and two DC lights that are wired and ready for use.

Figure 1: Schematic of a PV Stand-Alone System



The solar PV module produces electricity when sunlight strikes its surface. The amount of electricity produced is directly proportional to the intensity and duration of sunlight falling on the module and on the size of the module surface area. Typically modules are rated by the amount of power (watts) generated when sunlight equivalent to noonday sun strikes its surface and the output is given as Peak Watts (Wp). Typical modules used in China are rated at 10, 20, 36 or 38 and 50 Wp and power is generated usually at 12 volt (V) direct current (DC). Modules can be combined into arrays to give more power. For example, two 50 Wp modules can be combined to give100 Wp of power.

Wind generators used in the PV-hybrids systems are typically rated at 100 to 300 watts. The amount of electricity generated is proportional to the wind turbine rating and the wind speed at its hub height. PV/wind hybrids are especially valuable in areas where there is good complementarity in the availability of sunlight and wind power. Inner Mongolia is one such area as the wind speeds in Inner Mongolia are strong in winter when sunlight conditions are poorest.

The electricity generated by the PV module and wind turbine is stored in a lead-acid battery so that the consumer can use the electricity when needed. Batteries are sized so that they can safely meet the loads the system was designed to serve. Since batteries can be damaged by overcharging or overdischarging, some means of preventing this is included. For very small systems (e.g., 10 Wp), this protection may be a simple voltmeter and an audible alarm or indicator that warns the consumer to stop further charging or discharging. In larger systems, an electronic charge/discharge controller is used, which automatically prevents excess charging or discharging of the battery.

Usually in small PV systems, 12 V DC electricity is used to operate lights or other appliances as converting it to alternating current wastes energy. Efficient fluorescent lights and small appliances such as televisions that operate on direct current are available in China. In larger PV systems and in PV/wind hybrids consumers may prefer to use an inverter, which converts the DC current into alternating current at normal household voltage of 220 V. This would permit the consumer to use a wider range of appliances.

The amount of electricity services available from a PV system varies from region to region and from season to season as sunlight availability changes. For example, solar radiation levels in Qinghai and Tibet are better than in Gansu or Inner Mongolia and solar radiation in winter months is less than in summer.

Technical Specifications. To be eligible for the grant under this project, PV and PV/wind hybrid systems must be certified as meeting the technical standards established for the project. The specifications were formulated using a participatory process involving Chinese and international PV companies, research institutes, and testing and certification organizations. SETC appointed a PV Standards Committee that, together with an international PV advisor, had primary responsibility for specifications formulation. The specifications were issued in October 1998 by the PMO to permit the companies adequate time to ensure that their products could meet the specifications. A copy of the Technical Specifications is included in the PIP.

Where they were available, international or Chinese national standards were used for PV modules, batteries and wind turbines. Project-specific standards were established for controllers, fluorescent light fixtures and DC/AC inverters sold as part of the systems. The PMO also identified a number of testing and certification agencies who could certify these products. They are:

- Shanghai Institute for Space Power Sources and Tianjin Institute for Power Systems for PV modules;
- China Certification and Testing Station for Lighting Electrical Products in Beijing for fluorescent luminaire;
- Postal and Telecommunications Industry Standardization Institute in Beijing for batteries, controllers and inverters;

- Beijing Badaling Wind Turbine Testing Field or the Hohhot Livestock Machinery Research Institute for wind turbines and controllers; and
- Other international or Chinese testing and certification institute with ISO 25 or equivalent accreditation that are acceptable to SETC and the Bank.

During project preparation, assistance was provided to prospective suppliers to help improve project quality and to have their products tested and certified. This helps ensure that qualified products will be available for marketing and sale by the participating companies by Project effectiveness.

Target Markets. The rapidly increasing sales of existing PV companies provides strong evidence of a commercial market among the estimated 2-7 million households without electricity service in Inner Mongolia, Qinghai, Xinjiang and Gansu Provinces, and adjacent areas. The 17 companies participating in business plan preparation reported that their sales of PV systems increased from 423 kWp (17,600 systems) in 1995 to 917 kWp (44,600 systems) in 1997, an increase of 117 percent in annual sales in two years.[2] The Project's scale is conservative, given that current sales are already equal to almost half of the average level of sales targeted during the project, 2 MW per year. Sales projections by participating companies exceed the Project targets. While the Project is expected to assist the expansion of the market, its greatest impact would be in improving system and service quality, deepening the future market by developing financing mechanisms, and increasing the long-term sustainability of the market for PV systems in rural areas.

A survey is under way to assist the companies to identify the characteristics of purchasers of PV systems, their service requirements and preferred payment patterns. Final results of the survey are available in the Project files.

The PV Component will support the sale of PV systems that range from 10 Wp PV systems to PV/wind hybrid systems that consist of up to 200 Wp PV and 300 W wind. The product mix would depend on market demand and would vary regionally. For example, demand for hybrid systems would be predominantly in Inner Mongolia where seasonal wind and solar resource availability is highly complementary. An indicative estimate of system sales by size has been prepared from the sales projections of PV companies, as shown below.

Table 2: Estimated Sales of PV Systems under Project

	1999	2000	2001	2002	2003	2004	Total
No. of Units (thousands)	22	53	62	76	84	41	339
Total MWp	0.5	1.4	1.8	2.4	2.6	1.3	10.0
Average Size (Wp/system)	23	26	27	32	34	32	30

Note: Sales for 1999 and 2004 are for half a year. Sales include systems of 10 Wp or greater.
Source: Participating Companies sales forecasts

Market Development Program Subcomponent ($7.0 million: GEF $5 million)

The Market Development Program would complement the investment subcomponent by supporting activities to catalyze market development, such as increasing consumer awareness and strengthening commercial capabilities of companies and developing consumer finance mechanisms. A program approach would create synergy among the activities and maximize their combined impact. The PMO will be responsible for developing and managing the program, in coordination with the Bank. The PMO will monitor development of the market, obtaining feedback on the project activities from consumers,

2 Includes sales in Gansu, Inner Mongolia, Qinghai, Xinjiang as well as sales in Sichuan, Tibet and other outlying provinces.

participating companies, local governments and other stakeholders. It will seek requests or proposals for grant-assisted activities that would assist market development from consumers, communities and companies, and develop ideas for activities that respond to market conditions. Most of the activities will be carried out by subcontractors, or project participants. The GEF grants will provide full or partial funding, depending on the type of activity and cofinancing from sponsors.

The PMO has developed, with the assistance of the Bank project team, an overall strategy for the Program that (a) defines the framework and tentative funding allocations for the program, (b) outlines the kinds of activities to be undertaken, and (c) indicates who would undertake them and how they would be identified. Each year, the PMO would prepare a one-year detailed work program that would be approved by the Bank. This program would show for each major activity the implementation plan, the budget and grant support needed, and the expected results in relation to the overall project objectives.

The initial framework of Market Development Support Program activities and tentative funding levels are as follows:

- *Public Information Program ($0.35 million: GEF $0.25 million).* The program would: (a) provide objective information to consumers on product quality, performance, costs, warranties and consumer protection measures using radio, television and newspaper advertisements etc.; and (b) inform PV companies about qualified suppliers and products.
- *Business Development Support ($2.1 million: GEF $1.5 million).* A business advisor, supported by specialized expertise as necessary, would provide training and support to participating companies, in response to their needs, in areas such as: (a) financial management, contract management, accounting and auditing; (b) development of sales and service networks; (c) product development and quality control; (d) marketing (surveys, promotion, small demonstrations); and (e) industry association/ accreditation.
- *Consumer Financing Mechanisms ($4.2 million: GEF $3.0 million*) Because of the importance of increasing affordability, funds have been tentatively designated for supporting development of financing mechanisms. As consumer financing is not yet available even in urban China, the first step would be a study of the options, by credit specialists and sociologists/anthropologists and micro/rural finance specialists who are knowledgeable about the socioeconomic situation in the areas targeted by the project (estimated cost: $200,000). The study would: (a) investigate financing options for different types of consumers, (b) recommend mechanisms for support, and (c) recommend an action plan to the PMO. Possible support mechanisms include partial guarantees to cooperatives, PV system companies or banks; cofinancing of loans from commercial banks; and limited support for pilot credit schemes by dealers. The remaining funds are to be used to implement the action plan proposed by the study. In the event that the study does not recommend establishing a financing scheme, the remaining funds would be reallocated.
- *Market Monitoring Program ($0.35 million: GEF $0.25 million).* This program would solicit feedback from companies and consumers on market developments and program activities, as well as ideas for future activities. It would also provide consumer protection by making available channels for consumers to complain, receive compensation, or provide feedback on company performance. It would begin early and continue throughout the project.

Institutional Strengthening Subcomponent ($4 million: GEF grant $2 million)

This subcomponent would support the following activities:

- *Product Quality Assurance ($2 million: GEF $1 million).* Quality and performance of PV systems and components (including modules, inverters, controllers, batteries and lights) would be improved by: (a) strengthening the testing and certification capabilities of the institutions involved in certifying PV module, controllers, inverters and lights; (b) introducing national system and component

standards, building on the Project standards; and (c) providing assistance to companies to improve product quality and performance and to implement quality assurance measures.

- *Project Management ($2 million: GEF $1 million).* TA and training, including international advisor(s), would be provided to strengthen the PMO capacity in the following areas: (a) project management, including contract management, accounting, financial management and grant processing; (b) updating the Market Development Program strategy and preparing the detailed annual program; (c) monitoring the project, including audits, and focus group sessions.

C. TECHNOLOGY IMPROVEMENT PROGRAM ($79.6 MILLION)

Overview

Under this component, cost reduction of the identified PV and wind components would be achieved by providing financial support to industry for investments in technology innovation, and by institutional strengthening activities. This component has two parts: (a) investment in technology improvement; and (b) institutional strengthening.

Investment in Technology Improvement ($78 Million, $9 Million GEF)

This subcomponent would provide grants to companies to share the costs of projects to accelerate technology innovation, with the aim of reducing costs of equipment available in China, while providing high-quality products and performance. There would be three main elements: (a) grant-assisted technology improvement projects (matching grants to competitively selected projects); (b) grant-assisted small technology improvement projects (quick-response matching grants); and (c) production investment projects assisted by loans.

Grant-Assisted Technology Improvement Projects ($16 million: $8 million GEF)

The choice of a program that is cost-shared with industry is based on the successes of these kinds of programs for renewable energy technologies in the Netherlands, European Union, the United States and Japan. Cost-shared programs to improve technology have also been successfully implemented in developing countries, although not specifically on renewable energy, e.g., the PACER program in India.

Grants would be provided to share up to 50 percent of the costs of projects. Beneficiaries would be selected competitively based on proposals submitted by companies or institutions, in response to invitations issued periodically by the PMO. Proposals would be evaluated and ranked by technical experts (including international experts), and selected by the PMO based on the ranking, subject to the Bank's no-objection.

The opportunity to obtain financial support for technology improvement of PV and wind equipment would be widely promoted. This has already begun through an industry consultation meeting during project preparation. Visits would be made to potential participating industries, workshops would be held and the program would be announced in the media. Invitations for proposals would be issued by the PMO periodically. The industries would be requested to prepare proposals for projects that lead to cost reduction of PV and wind components and that are cost-shared by the industry. Each proposal would contain a business plan that showed the impact of the results on the company's future business activities.

The proposals would be evaluated and ranked using established selection criteria. The highest ranked proposals would be accepted and funded until the funds allocated for that specific time period were exhausted. The PMO would enter into contracts with the companies/institutions whose proposals are accepted. In these contracts, it will be specified how the grants will be disbursed against progress achieved.

Guiding Principles. The program would:

- be market-driven and results-oriented;
- aim for results in the Chinese market primarily in the short to medium term (within five years);
- be open to all interested and capable industries and institutions.

Selection Criteria. The selection criteria for ranking and evaluating the proposed projects are:

- contribution of the proposed project to achieving the program objective (cost reduction and/or quality improvement of wind and PV components or systems on the short/medium term);
- cost effectiveness of the proposal (the ratio of the contribution to achieving the objectives of the program with the financial support requested from the program);
- probability of achieving the objective(s) as formulated in the proposed project (chances of success).

The contribution of the proposed project to achieving the objective would be measured by the cost reduction or quality improvement of a certain component or system as documented in the proposal and the relative importance of that component or system. The determining factor is the effect on the price to the end-user for a certain service and the potential demand.

Chances of success of technology improvement are in general higher if participating parties work together. In particular if there is cooperation between parties involved in design, production and marketing. Further, previous experience in wind and PV technology and with technology improvement would increase the chances of success of the proposal substantially.

Eligible Industries and Institutions. Entities that are eligible for financial support from the Program would be:

- industries presently involved in, or have the capacity for, production of PV and wind systems and components.
- institutions (e.g., research, development, testing, certification and standardization) if their activities are directly relevant to wind and PV equipment production (lowering cost and/or improving quality).

The grants would be available to all companies and institutions that are legally registered in China.

Types of Activities Supported. Technology improvement in general would cover a range of activities from technology transfer through national technology development.[3] Through this, the share of locally manufactured, lower-cost components of PV and wind systems would increase, while the quality would be maintained at desirable levels. This process would lead to lower cost of systems and better adaptation of the systems to the Chinese circumstances.

The program would thus support activities such as the following, in relation to production of wind and PV system components:

- production of prototypes;
- testing and certification;
- field testing of new equipment;
- labor, equipment, consulting services and travel costs for applied research and development;
- identification of potential local and foreign partners for local production;
- assessment of the feasibility of cooperation with a local or foreign partner (joint ventures).

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[3] Technology Improvement is defined as activities that lead to products that are of lower cost and/or improved quality. Technology Transfer is obtaining a technology from somewhere else, including the knowledge to operate, maintain, repair and build on it. Technology Development is technology improvement through research and development by the industry who wants to improve its product. TI can entail either TT or TD, or both.

The funds would not be used to support investments in production, obtaining a license or the investment in a joint venture, as these investments are considered standard business transactions. Further, these investments are in general much larger than investments in technology improvement and, therefore, would quickly deplete the available funds. The program would not support:

- basic research;
- investment in industrial-scale manufacturing equipment;
- investments in joint ventures;
- purchase of licenses;
- market development and investments in turbines or PV systems;
- institutional strengthening and TA if covered in other projects or in other components of the Renewable Energy Development Project.

Technology Areas Supported. Because of the limited funds available within the program, the support would focus on PV and wind components and systems that have potentially the highest impact on achieving the objective of the program in the medium term. Based on detailed industry surveys and an industry consultation, the following fields of activities have been selected for support.

In wind energy, China's comparative advantage is considered to be the potential for low-cost manufacture of components for large-scale systems provided by foreign suppliers, and for small wind generators for use in PV/wind hybrids. Therefore the technology improvement component would support wind activities that lead to cost reductions of:

- turbines (500 kW and above)
- blades for turbines (500 kW and above)
- gearboxes for turbines (500 kW and above)
- generators for turbines (500 kW and above)
- control systems for turbines (500 kW and above)
- system integration
- small wind generators (up to 500 W).

In PV, the comparative advantage of China is at present the manufacturing of small systems (under 30 Wp) for rural household applications. Presently, these systems are 25 percent lower in cost than similar imported systems. Quality, however, is a problem. Moreover, as rural incomes rise, the demand for larger systems will increase. Improving performance in this range could be the stepping stone to competitiveness in larger systems. Therefore, the technology improvement component would support PV activities that lead to improved quality and further cost reduction of PV systems or components used in off-grid rural applications:

- modules
- inverters
- controllers
- batteries
- system integration, including hybrids
- DC lights and other DC appliances such as television intended for use in solar home and rural applications.

The technology improvement activities supported are not limited to improvement of equipment, but also include improvement in installation practices.

Grant-Assisted Small Technology Investment Projects ($2.0 million: GEF $1.0 million)

In addition to the competitively selected grants, there would be a quick-response fund with limited budget, administered by the PMO, for grant amounts up to $10,000 per project. These funds are also provided on a cost-sharing basis up to 50 percent of the total project cost and could be requested throughout the year. Allocation is done on a first-come, first-served basis. For each year there would be an allocation under this system. The selection criteria would be the same as for the competitive matching grant system.

If a proposal is rated satisfactory on all criteria the proposal would be approved for funding so long as funds allocated for that year are available.

Production Investment Projects Assisted by Loans ($60 million)

An important part of the Program would be loans made available by commercial banks, with financial support from SETC, to manufacturing companies for bankable investment projects. These loans would be for purchase of production equipment, or other follow-up investments to grant-financed activities, in order to bring improved technologies into commercial production or use. Concessional terms of the loans would be the same as those on SETC Technical Retrofitting Loans, currently available with a subsidy up to 50 percent of commercial interest rates. Companies are expected to make equity investments of up to $10 million, in order to obtain loans totaling up to $50 million for a total investment of up to $60 million

Institutional Strengthening Subcomponent $1.6 Million: $1.0 million GEF)

This subcomponent would support the following:

Awareness Building and Program Support Activities: The PMO would undertake promotion and awareness activities, such as:

- workshops for industries on technology improvement in general and such activities in other countries;
- workshops for industries on technology transfer mechanisms;
- workshops on quality control and certification; and
- other workshops and seminars.

Further, the PMO would undertake activities to support the program, such as:

- develop and maintain a database on wind and PV components and system prices (selling and production); and
- conduct surveys to determine on which components to focus in the next invitation for proposals.

Program Management Support. Support would be provided for program management including solicitation of proposals from the industry; evaluation, ranking and selection of the proposals that best contribute to achieving the program objectives; signing contracts with the proponents of the selected proposals; monitoring and evaluation of the progress of the implementation of the contracted work; approval of grant disbursement in relation to progress; taking appropriate action if progress is insufficient; and, reporting on progress to the World Bank and GEF. International advisors would assist in solicitation of proposals.

Annex 3: Estimated Project Costs and Financing Plan

China: Renewable Energy Development Project

Estimated Project Costs

	Yuan Million			$ million			Foreign
	Local	Foreign	Total	Local	Foreign	Total	(% of total)
A. Windfarm Component							
Investments	411.4	1,102.6	1,514.0	48.0	132.9	180.8	73
Huitengxile Windfarm	180.9	582.8	763.6	21.0	70.2	91.2	77
Zhangbei Windfarm	91.0	289.6	380.7	10.6	34.9	45.5	77
Pingtan Windfarm	57.0	111.7	168.7	6.9	13.5	20.3	66
Chongming & Nanhui Windfarms	82.5	118.5	201.0	9.6	14.3	23.8	60
Institutional Strengthening	24.9	24.9	49.8	3.0	3.0	6.0	50
Training	0.8	-	0.8	0.1	-	0.1	0
Engineering Services	0.8	-	0.8	0.1	-	0.1	0
Institutional Strengthening	23.2	24.9	48.1	2.8	3.0	5.8	52
Total Windfarm Component Base Cost	436.3	1,127.5	1,563.8	51.0	135.9	186.8	73
Taxes and Duties	42.1	-	42.1	5.1	-	5.1	
Physical Contingencies	36.9	50.7	87.5	4.3	6.1	10.4	59
Price Contingencies	35.2	87.9	123.0	0.5	1.2	1.7	70
Total Windfarm Component Project Cost	550.4	1,266.1	1,816.5	60.8	143.1	204.0	70
Interest During Construction /a	3.6	27.3	30.9	0.4	3.3	3.7	
IBRD Loan Service Fee	-	8.3	8.3	-	1.0	1.0	
Total Windfarm Component Financing Required	554.0	1,301.6	1,855.6	61.3	147.4	208.7	71
B. PV Component							
Investments							
10 MW PV Systems	693.5	190.7	884.3	83.6	23.0	106.5	22
Institutional Strengthening	78.7	12.4	91.1	9.5	1.5	11.0	14
Market Development Program	51.5	6.5	57.9	6.2	0.8	7.0	11
Institutional Strengthening	27.3	5.9	33.2	3.3	0.7	4.0	18
Total PV Component Base Cost	772.3	203.1	975.4	93.0	24.5	117.5	21
Taxes and Duties	177.0	-	177.0	21.3	-	21.3	
Price Contingencies	129.0	12.8	141.8	15.5	1.5	17.1	9
Total PV Component Financing Required	1,078.3	216.0	1,294.2	129.9	26.0	155.9	17
C. Technology Improvement							
Investments	265.6	381.8	647.4	36.4	41.6	78.0	53
Large Grant Program	83.0	49.8	132.8	10.4	5.6	16.0	35
Small Grant Program	16.6	-	16.6	2.0	-	2.0	0
Concessional Loans Program	166.0	332.0	498.0	24.0	36.0	60.0	60
Institutional Strengthening	10.0	3.3	13.3	1.2	0.4	1.6	25
Program Management	3.3	1.7	5.0	0.4	0.2	0.6	33
Institutional Strengthening	6.6	1.7	8.3	0.8	0.2	1.0	20
Total Technology Improvement Financing Required /b	275.6	385.1	660.7	37.6	42.0	79.6	53

	Yuan Million			$ million			Foreign
	Local	Foreign	Total	Local	Foreign	Total	(% of total)
D. Total Project							
Windfarm Component	436.3	1,127.5	1,563.8	51.0	135.9	186.8	73
PV Component	772.3	203.1	975.4	93.0	24.5	117.5	21
Technology Improvement Component	275.6	385.1	660.7	37.6	42.0	79.6	53
Total Project Base Cost	**1,484.1**	**1,715.8**	**3,199.9**	**181.6**	**202.3**	**383.9**	**53**
Taxes and Duties	219.1	-	219.1	26.4	-	26.4	
Physical Contingencies	36.9	50.7	87.5	4.3	6.1	10.4	59
Price Contingencies	164.2	100.7	264.8	16.1	2.7	18.8	15
Total Project Cost	**1,904.2**	**1,867.1**	**3,771.4**	**228.3**	**211.1**	**439.5**	**48**
Interest During Construction a/	3.6	27.3	30.9	0.4	3.3	3.7	
IBRD Loan Service Fee	-	8.3	8.3	-	1.0	1.0	
Total Project Financing Required	**1,907.8**	**1,902.7**	**3,810.5**	**228.8**	**215.4**	**444.2**	49

Exchange Rate: Y 8.3/$1.

/a Interest during construction (IDC) is based on onlending rates for project disbursements of loan proceeds. The foreign currency portion is based on the Bank's variable loan rate.

/b Taxes and duties are included. The amounts will be known only after proposals funded under the program are submitted by companies.

Financing Plan

	($ millions) Local	Foreign	Total
A. Windfarm Component			
INVESTMENT COMPONENT			
IBRD	-	100.0	100.0
SP	17.1	-	17.1
Provincial/Municipal Power Companies	23.4	-	23.4
Domestic Commercial Banks	17.7	44.4	62.1
Subtotal	58.3	144.4	202.7
INSTITUTIONAL STRENGTHENING			
GEF	-	3.0	3.0
SP	3.0	-	3.0
Subtotal	3.0	3.0	6.0
B. PV Market Development Component			
INVESTMENT COMPONENT			
GEF	-	15.0	15.0
Participating Companies & End-users	120.4	9.5	130.0
Subtotal	120.4	24.5	145.0
INSTITUTIONAL STRENGTHENING			
GEF	5.5	1.5	7.0
Participating Companies	2.2	-	2.2
GOC (SETC)	1.8	-	1.8
Subtotal	9.5	1.5	11.0
C. Technology Improvement Component			
INVESTMENT COMPONENT			
GEF	6.2	2.8	9.0
Participating Companies	10.2	8.8	19.0
Domestic Commercial Banks	20.0	30.0	50.0
Subtotal	36.4	41.6	78.0
INSTITUTIONAL STRENGTHENING			
GEF	0.6	0.4	1.0
Participating Companies	0.4	-	0.4
GOC (SETC)	0.2	-	0.2
Subtotal	1.2	0.4	1.6
D. Total Project	228.8	215.4	444.2
IBRD	-	100.0	100.0
GEF	12.3	22.7	35.0
SP	20.1	-	20.1
Provincial Power Companies	23.4	-	23.4
Domestic Commercial Banks	37.7	74.4	112.1
Participating Companies & End-users	133.2	18.3	151.5
GOC (SETC)	2.0	-	2.0

Including contingencies, duties and taxes, IBRD loan service fee and IDC.

Annex 4: Institutional Strengthening Before Project

China: Renewable Energy Development Project

A: GOC/BANK SECTOR WORK IN RENEWABLE ENERGY PRIOR TO PROJECT IDENTIFICATION

Introduction. One of the main challenges facing GOC is the need to reduce reliance on coal, with its associated negative environmental impacts. This has led to an increased emphasis on policies to support renewable energy development. In 1995, the State Planning Commission (SDPC), the State Science and Technology Commission (SSTC) and the State Economic and Trade Commission (SETC) jointly developed a "Program of New and Renewable Energy Development, 1996-2010," and an implementation plan for the Ninth Five-Year Plan.

The China Renewable Energy Development Project is the result of a long history of GOC/World Bank sector studies to support this program, carried out by teams of Chinese and international experts. These studies began in 1995, as the result of a request from GOC for Bank assistance to develop a renewable energy project in China, with GEF support. They include the following major activities:

- Renewable Energy for Electric Power Study, September 1996.
- Renewable Energy for Thermal Applications Study, November 1996.
- Strategy for International Assistance to Accelerate Renewable Energy Development, July 1997.
- Financial Incentive Policies for Renewable Energy Development Technical Assistance, November 1997.

This Bank/GOC collaborative sector work on renewable energy has been assisted by support from the Global Environment Facility (GEF), the Netherlands Directorate General for International Cooperation (DGIS), the UNDP Energy and Atmosphere Program, as well as United States, United Kingdom, and New Zealand bilateral agencies.

A description of each of the main activities, including their scope and results, are given below.

China: Renewable Energy for Electric Power Study, September 1996. The objective of this study was to identify priorities for power-related energy development in China.[1] It included assessments of the economic and financial viability of selected technology applications, a review of institutional and policy issues affecting their development, and an outline of priorities for investment and technical assistance support. The study covered both grid-connected and off-grid applications of renewable energy for power. Five technology applications were selected for detailed, site-specific case study assessments: windfarms, photovoltaic (PV) solar home systems, bagasse cogeneration facilities, biogas power generation plants at large husbandry operations, and geothermal power systems.

The study was carried out by a group of Chinese and international experts during July 1995-September 1996. In China, it was led by SETC, which is responsible for commercialization of renewable energy. In the World Bank, it was led by the Asia Alternative Energy Program (ASTAE) and the former Industry and Energy Department (IENPD).

The study examined the status of renewable energy in China, highlighting China's "world-class" renewable energy resources and impressive efforts to commercialize small hydropower systems and small wind-generation units. The study noted, however, that under current GOC plans, renewable energy (excluding small hydropower) would only account for 1 percent of total generating capacity by 2010. A stronger GOC program is urgently needed to develop a commercial renewable energy industry. The

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[1] See *Renewable Energy for Electric Power*, 1996 (World Bank Report No. 15592-CHA).

development of such an industry needs to be supported by GOC using a market-based approach that reduces project development costs and investor risk, improves access to credit, supports development of high-quality, low-cost local technologies, and uses carefully structuring financial incentives to support specific market development and cost reduction goals.

The study identified investment and technical assistance priorities for power-related renewable energy development. In particular, grid-connected windfarms, PV solar home systems, and bagasse cogeneration facilities were identified as high priorities for investment.

China: Renewable Energy for Thermal Applications Study, November 1996. This sector study was organized and executed by SETC, with assistance from GEF and the Bank, to complement the study on power-related renewable energy development. International experts from the United States National Renewable Energy Laboratory (NREL) were hired by SETC to assist with analysis of four technology applications with potential for large-scale development in China: (a) geothermal district heating systems, (b) biomass gasification for industrial heating applications (e.g., timber drying), (c) solar water heating for commercial applications (e.g., hotels), and (d) anaerobic digestion of industrial waste (e.g., at distilleries). Case studies (including economic and financial assessments as well as institutional and policy analysis) were performed for each of the selected applications. The primary outputs of this activity were four technology application reports that presented and summarized the case study analyses and recommended technology-specific development strategies including investment and technical assistance priorities for accelerated development.

The recommendations in the case study analyses regarding institutional and policy priorities are similar to those identified in the study of power-related applications: hardware and project development practices need to be commercialized and expanded, financial incentives are required to help overcome barriers to market expansion, and access to credit must be improved. In addition, solar water heating and biomass gasification applications are determined to be the technology applications with the greatest potential for large-scale development.

China: Strategy for International Assistance to Accelerate Renewable Energy Development, July 1997. This report, prepared by the China and Mongolia Department of the World Bank with assistance from ASTAE, summarized the results of the two sector studies and extensive discussions with staff from SETC, many other Chinese agencies and groups, and UNDP. It was intended to help focus the attention of decisionmakers in bilateral and multilateral development agencies on the need for major investment and TA activities to support renewable energy in China, and to identify priority areas for such assistance. It included: (a) an overview of China's efforts to implement a more market-oriented renewable energy development strategy; (b) an outline of areas where international assistance can help strengthen policy development and institutional capacity building; and (c) an outline of China's current development programs for eight promising renewable energy technologies, and identification of priority areas for international assistance The primary output of this work was a strategy document published by the World Bank, for wide dissemination.[2] The World Bank and UNDP are now preparing complementary GEF-assisted projects, to assist China in a number of the priority areas identified in the strategy document.

China: Financial Incentive Policies for Renewable Energy Development Technical Assistance, November 1997. International experience shows that financial incentives and other government policies are key to commercializing renewable energy in its early stages. As a follow-up to the sector work and strategy document, the World Bank and SETC initiated this TA in July 1996, with financial support from the ASTAE Netherlands Trust Fund. The objective was to assist GOC in developing recommendations for changes, where necessary, to China's current system of financial incentives for increasing market-based

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2 See *China: A Strategy for International Assistance to Accelerate Renewable Energy Development, 1997* (World Bank Discussion Paper No. 388).

development of renewable energy technologies, establishing local manufacturing of advanced technologies and reducing associated costs. Participants included a GOC coordinating group (consisting of representatives from SETC, SDPC, SSTC, and the Ministries of Finance, Electric Power, and Agriculture), local and international experts, and Bank staff.

Local experts prepared a background paper outlining China's current renewable energy policies and financial incentives. In February 1997, the World Bank held a workshop that brought together senior GOC officials, Bank staff, and senior government officials from six countries with experience in designing and implementing financial incentives for commercial renewable energy development. Incentives offered in each of the countries were discussed along with their results in terms of installed capacity, technology costs, and manufacturing capacity.[3] Subsequent to the workshop, local experts from GOC prepared a draft report containing analysis of the barriers to renewable energy development in China, financial incentives options for removing these barriers and recommendations for changes. The draft report was reviewed by the Bank, and a final report was submitted to the Bank by GOC in February 1998.[4]

GOC has already acted to implement some of the recommendations of the studies and has submitted a proposal to State Council. One key measure implemented in early 1998, as a result of the TA and ongoing efforts by participating agencies, was to make renewable energy eligible for exemption from customs duties and VAT. Also, GOC has agreed to extend the "new plant, new price" policy for investments in wind power. This policy ensures that the power purchase price paid to wind power installations is sufficient to cover debt servicing, operating expenses, and a reasonable rate of return to investors. The incremental cost of wind power over that from conventional facilities would be passed on to electricity consumers.

China Renewable Energy Development Project. The China Renewable Energy Development Project builds upon the results and substantial work and effort invested in each of the sector studies and technical assistance activities. The Project focuses on two technology applications identified as priorities for investment and technical assistance: grid-connected windfarms and off-grid PV systems. Investment projects for these applications would be developed in a commercial framework designed to encourage efficient business operations and future nonutility participation. In addition, it is anticipated that GOC would continue to adopt policy recommendations identified in the TA. These policies are expected to apply to investments made within the Bank project as well as future efforts of government, private and joint-venture investors.

B. INSTITUTIONAL STRENGTHENING DURING PROJECT PREPARATION

Introduction

The China Renewable Energy Development Component involves a large and diverse number of participants. Participants include the Project Management Office (PMO) of SETC, and SP, the government agencies responsible for coordination, project management and monitoring; the PV, windfarm, and equipment manufacturing companies that are responsible for implementing the investment components of the project; testing and certification organizations who are needed to certify equipment; supplies and manufactures of PV and wind equipment. Building the capacities of each of these key players is essential if the project is to succeed in reaching the development objective of expanding PV and windfarm markets.

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3 See *Financial Incentives for Renewable Energy Development*, 1998 (World Bank Discussion Paper No. 391).

4 This report, *Financial Policies for Renewable Energy Development,* has been accepted for publication in the Bank's new EAP Discussion Series.

Project preparation funds were mobilized from GEF ($590,000), PHRD ($433,000) and other trust funds, in order to begin strengthening the capacity of participants as early as possible during project preparation. As a result, it is expected that implementation of the project can begin immediately after effectiveness. Institutional strengthening activities during project preparation are described below for each project component.

Windfarm Development Component

Institutional strengthening activities during project preparation focused on activities required to develop the windfarm investment projects in Inner Mongolia, Hebei and Fujian Provinces, and Shanghai. International consultants provided training to representatives from provincial electric power design institutes, the wind power companies to be formed for developing the investment projects, the respective electric power companies, and SP. Specific activities, which are further discussed below, include:

- Training for Preparing Feasibility Studies,
- Training for Preparing Power Purchase Agreements, and
- Training for Power Purchase Tariffs for Windfarm Projects.

Training for Preparing Feasibility Studies. International consultants provided training for preparing windfarm feasibility studies to the electric power design institutes from Inner Mongolia (responsible for the feasibility studies for the Huitengxile and Zhangbei Windfarms), Fujian Province, and Shanghai Municipality. In particular, training was provided on performing wind resource assessments (including correlation with long-term wind-speed data), calculating energy production estimates (including estimating energy losses), civil work design, cost estimates, construction management plans, O&M plans, and environmental and social impacts. Training was provided to the design institutes individually as well as collectively, and was tailored to each windfarm's characteristics (e.g., discussion of equipment specifications for cold-weather climates such as Huitengxile).

Training on Preparing Power Purchase Agreements. Representatives from the future windfarm companies (i.e., the sellers of electricity) and respective electric power companies (i.e., the buyers of electricity from the windfarms) as well as SP received training on developing PPAs for windfarm projects. International consultants provided training on international best practice and limited recourse financing standards for PPAs, including commercial and negotiable elements. Training continued through project appraisal to ensure that PPAs are negotiated and signed within six months of the establishment of the windfarm companies.

Training on Formulating Power Purchase Tariffs. An international power tariff expert provided training on international best practice for windfarm power purchase tariffs to representatives from the future windfarm companies, the respective electric power companies and SP. Tariff structures for windfarm projects in seven countries were reviewed. A direct result of the training was the development of a power tariff structure by SP for the five windfarm investments under the Project.

PV Market Development Component

Institutional strengthening during project preparation addressed a number of key concerns: (a) improving the commercial capability of the participating companies to expand their PV businesses; (b) improving the quality of products available to consumers; (c) strengthening project management capabilities; and (d) strengthening the capacity of testing centers and companies for product quality assurance. The main institutional strengthening activities carried out during project preparation are described below:

- Business Development Assistance for Participating PV Companies
- Market Survey for PV Systems in Four Provinces
- Technical Product Specifications for PV Systems and for PV/Wind Hybrids
- PV Product Quality Improvement

- PV Product Certification
- Testing & Certification Institution Capability Strengthening.

Business Development Assistance. Through a process involving the PMO, provincial ETCs and interested PV companies in the four provinces, 17 companies were selected to receive business development assistance. The companies received assistance to prepare business plans, including marketing plans, forecasts of sales, cash flow analyses, profit and loss statements, financial planning to determine collateral requirements and financing needs. Such support is essential for companies to obtain commercial loans to expand their operations. The companies are also receiving assistance in planning for the expansion of their businesses, including extending sales and service networks, developing warranty documents and setting up procedures for quality assurance. Assistance includes training sessions for participating PV companies in applying the business planning process and tools, and adapting them to their requirements. In addition, regular meetings are held with each of the PV companies to provide detailed guidance on their business plans, credit applications and proposed contracts and warranties.

Market Survey for PV Systems. A survey has been conducted to investigate the characteristics of the target households for the PV companies, including current PV system purchasers. Because these households live in remote areas, they are not well covered by data from the State Statistics Bureau. The survey, which was carefully designed to be representative, serves to provide baseline socioeconomic data, as well as market information. The survey identified socioeconomic characteristics of all households, as well as a subsample of PV system purchasers, covering characteristics such as income; assets, including livestock; experience with banks and credit history; current energy use; knowledge of PV; satisfaction with systems (for PV users). Focus group interviews were used as a supplement. Estimates were made of the size of the market as a function of level of service desired and ability-to-pay, using different payment mechanisms. The survey was conducted by a Chinese team assisted by an international survey expert. The results will be used to help participating PV companies prepare their marketing strategies.

Technical Product Specifications. Good product quality is essential for sustainable development of the PV market. PMO established a participatory process involving key research and testing organizations and PV module and balance of systems manufacturing companies to prepare technical product specifications. The specifications cover PV systems ranging in size from 10 W to about 500 Wp and includes PV/wind hybrids where the wind turbine rated capacity is 300 W or smaller. The PMO formed a PV Technical Standards Committee which prepared the draft specifications with assistance from an international expert. The draft was circulated to national and international PV companies and research institutes for comment.

After incorporating these comments, the technical standards were published and widely circulated to local and international companies in October 1998. The PMO has invited interested companies with products that can meet these specifications to submit expressions of interest along with certificates confirming that their products meet the specifications. The PMO will circulate this information to participating companies who can contact various qualified suppliers directly.

Product Quality Improvement. Experience in Indonesia and Sri Lanka has shown that suppliers need time to improve their product quality and that if implementation is not to be delayed, it is important to have qualified products available by project effectiveness. Examination of existing PV products in the market and discussions with local suppliers indicated that there are opportunities for improving the quality and performance of the products. TA from a PV testing agency in the Netherlands was provided to help improve product quality beginning in about July 1998. Samples of controllers, lights and inverters were tested and where necessary redesigned. These recommendations were provided to PV suppliers to help them improve their products.

Product Certification. The PMO with assistance from an international PV advisor identified the Tianjin Institute for Power Systems, Postal and Telecommunications Industry Standardization Institute and the

China Certification and Testing Station for Lighting Electrical Products as institutes that could test and certify key PV system components. The PMO contracted an international PV systems testing and certification expert to advise the testing institutes on developing suitable testing procedures. These procedures were developed by April 1999. PV companies can avail of testing services of these institutes, with funding provided through grant funds obtained for project preparation to have their products tested and certified.

Testing and Certification Institution Capability Strengthening. The PMO obtained the services of an international PV systems testing expert to assess the current capabilities of the three testing institutes mentioned above. Based on an evaluation of the capabilities of the testing institutes and a discussion on their requirements, the expert drafted a program to help improve the capacity of these institutes to test and certify PV products. The proposed program was discussed with the concerned institutions and through a consultative process agreement, was reached as to the scope and priority areas for strengthening. The program is designed to help these institutions obtain ISO-25 accreditation. Institutional strengthening activities will continue under the project.

Technology Improvement Program

The objective of this program is to lower cost and improve the quality of PV and wind equipment available in China. This program will support both technology transfer and technology development as a means for lowering cost and improving quality of wind and PV components and systems in the Chinese market. The PMO assembled three committees of experts to help design this component. The three committees were focused on: (a) program development, (b) status of the wind industry in China, and (c) the status of PV industry in China . The Committees were assisted by an international expert team, including an expert from NOVEM, the Netherlands Agency for Energy and Environment.[5] The Expert Group consulted with Chinese companies and prepared the program, with the assistance of their international advisors.

Study Tour to the Netherlands. Representatives of the PMO and the Chinese Expert Group visited Netherlands to review how the Dutch technology improvement program was managed and to also meet with Dutch industry and research organizations to discuss how a similar program could be structured and used in China. Also, the Chinese team visited industries in Denmark and Germany.

Project Implementation Plan. A PMO team supported by Chinese and international consultants is preparing a detailed project implementation plan. The PIP addresses the following topics, among others: strategy and implementation plan, management structure, performance indicators and end-of-project targets, quality assurance, World Bank supervision and mid-term review, compliance and performance monitoring, reporting, project budget and procurement. Through the preparation of the plan, the PMO is developing some of the mechanisms required to implement the program, such as the application forms, the evaluation criteria and the evaluation process.

Industry Consultation Meeting. The PMO organized and conducted an industry consultation meeting for PV and wind companies and institutions, both national and foreign. In this meeting, the outline of the technology improvement component was presented and feedback was obtained on how to improve the component to fit the requirements of the target beneficiaries. Participants from 139 wind and PV companies and institutions participated, including 11 participants from countries other than China.

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5 NOVEM, which has successfully managing a technology improvement program for both PV and wind technologies, provided resources to support their staff and outside experts in this effort.

Annex 5: Project Justification: Cost Benefit Analysis Summary and Incremental Cost Analysis

China: Renewable Energy Development Project

A. COST-BENEFIT ANALYSIS SUMMARY FOR WINDFARM INVESTMENT

Methodology

The economic analysis for the Windfarm investments was carried out by the Beijing Research Institute for Water Resources and Electric Power (BERI), in conjunction with SP and the windfarm companies. The detailed report, "Economic Analysis on China Renewable Energy Project: Windfarm Component" (November 1998) is in the project files. The analysis was conducted in two steps: (a) a least-cost study to determine under what conditions windfarms are part of the generation mix; and (b) cost-benefit analysis. In both steps, the analysis was done with and without estimated local and global environmental costs of thermal power development.

Shadow Pricing. All economic analysis was based on input costs that have been adjusted to their economic value. Imported goods and services were valued at their estimated CIF values, using a conversion factor of 1.0. Domestically produced goods and services were valued at their shadow prices using specific conversion factors. All costs and prices were expressed in 1998 Yuan, using the official exchange rate at the time of preappraisal (Y 8.3/$1.0). The discount rate was assumed to be 12 percent.

Environmental Externality Costs. BERI conducted an economic evaluation of the environmental impacts of the project. It used: (a) the "Benefits Transfer Method" and the New York Externality Model (Rowe et al., 1994) to determine adjusted estimates of the monetary damages caused by air pollution during the study period, taking into account the location of the power plant, the emission level and the population affected; and (b) estimates of average annual climate change damage for carbon emissions to evaluate the monetary damages caused by greenhouse gas emissions.[1]

Least-Cost Analysis

A least-cost study was carried out using a planning model that determines the optimum capacity and generation mix to meet the demand in the most cost-effective way (minimum net present value of investment and operating costs.) Least-cost analysis was done separately for: the Jing-Jin-Tang (JJT) Power Grid (Huitengxile and Zhangbei Windfarms), the Fujian Grid (Pingtan Windfarm), and the Shanghai Grid (Chongming and Nanhui Windfarms.) This analysis was based on recent least-cost expansion plans prepared for other Bank projects. The planning period considered was 1998-2017, while the study covered an additional 15 years to reflect the long life of power plants in the economic evaluation. Windfarms were simulated as run-of-the-river hydro stations, with forced output and maximum available capacity. The alternatives considered for each grid include all possible candidates: coal-fired thermal plants (300-600 MW) within and outside (power transfers) each grid, new pumped storage plants, and gas turbine and combined cycle plants using distillate.

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1 This approach is outlined in *Economic Evaluation of Environmental Impacts Workbook*, March 1996, ADB. The estimates of damage costs ($/ton/person) from power plants in New York, are adjusted by per capita GDP (purchasing power parity), and combined with estimates of numbers of people affected, to value the impacts of TSP, SO_2, and NO_x on local, regional and distant areas. BERI did not model each power plant separately for environmental impact, but rather used regional averages.

This analysis showed that Huitengxile, Zhangbei and Pingtan Windfarms would be selected as part of the least-cost mix on the JJT grid if local externalities were incorporated. The Chongming/Nanhui Windfarms on the Shanghai Grid would not be selected even with consideration of both local and global externalities.

The difference in the average incremental cost (AIC) for expansion of each grid with and without windfarms was calculated (without considering externalities). Because of the small capacity of the windfarms compared to the grid, the increase in AIC is insignificant, varying from 0.05 Fen/kWh for Huitengxile and Zhangbei combined on the JJT grid to 0.01 Fen/kWh for Pingtan on the Fujian grid.

A complementary analysis was done assuming a 20 percent premium on the exchange rate (due to trade distortions). The result showed that the Pingtan windfarm remained part of the least-cost generation mix if only local environmental impacts were considered, while Huitengxile and Zhangbei windfarms remained part of the least-cost mix if both local and global impacts were considered. If a 30 percent premium is assumed, only the Pingtan windfarm remained part of the least-cost mix, if local impacts are considered.

Summary of Benefits and Costs, Base Case
(1998 Million Yuan)

Project	Present Value of Economic Flows	Present Value of Financial Flows	Fiscal Impact-Taxes (NPV)	Fiscal Impact-Subsidies
Huitengxile Windfarm				
Benefits	871	1,014	154 (VAT)	
Costs	784	936	114 (Income)	
Net Benefits	87	78	12 (Sales)	
IRR	14.1%	14.1%		
Zhangbei Windfarm				
Benefits	435	505	77 (VAT)	
Costs	393	467	57 (Income)	
Net Benefits	42	38	6 (Sales)	
IRR	14.1%	14.0%		
Pingtan Windfarm				
Benefits	173	254	39 (VAT)	
Costs	165	224	32 (Income)	
Net Benefits	8	30	3 (Sales)	
IRR	13.1%	15.5%		
Chongming/Nanhui Windfarm				
Benefits	152	291	45 (VAT)	
Costs	185	250	38 (Income)	
Net Benefits	-33	41	4 (Sales)	
IRR	8.4%	16.2%		

Cost benefit analyses were conducted by BERI to confirm the economic viability of the windfarms. Revenues (proxy for benefits) were estimated as the average tariff paid to generation plants on the grid in 1997. This estimate of benefits is more conservative than using the willingness-to-pay approach as used in the Bank's thermal power plants in China. This approach was taken in recognition of the fact that the nondispatchability of the windfarms should be taken into account. The EIRR for each windfarm was calculated for the Base Case, including both local and global environmental externalities, then with only local externalities and finally with no externalities. The results indicated that the Huitengxile, and Zhangbei windfarms are economically viable with consideration of local externalities, Pingtan windfarm is economically viable when both local and global externalities are included, and the Chongming/Nanhui windfarms are not viable even with inclusion of both local and global externalities.

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
Average Tariff at Generation Plant (Yuan/kWh)	0.268	0.268	0.323	0.410
EIRR (%)				
With local and global externalities (Base Case)	14.1	14.1	13.1	8.4
With local externalities	12.6	12.7	11.6	7.6
No externalities	5.4	5.1	5.9	5.0
NPV (million 1998 $)				
With local and global externalities (Base Case)	10.5	5.1	1.0	-3.9
With local externalities	3.2	1.6	-0.4	-4.7
No externalities	-32.6	-16.9	-5.7	-7.4

Sensitivity analyses showed that the EIRR in the Base Case dropped below 12 percent if the following occurred.

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
Decrease in average tariff or generation (%)	17.1	16.7	7.2	NA
Cost overrun (%)	11.1	10.8	5.1	NA
Commissioning delayed (year)	1.0	1.0	0.5	NA
Exchange rate increase (%)	15.8	15.3	8.6	NA

Risk analyses were carried out using Risk Master computer software (Monte Carlo Simulation),[2] to take into account uncertainties related to the chosen risk variables. The assumed value ranges of the four risk variables (including foreign exchange risk), the probability distribution of each, and the results, are presented in Figures 1-4. The weighted average of all simulated combinations for the Base Case EIRR for each windfarm ranges from 12 to 13 percent. The minimum and maximum EIRR, under the considered uncertainties, range from 4 to 5 percent to 21 to 25 percent, respectively. The probability of a negative outcome (negative net present value) ranges from 34 to 48 percent. This indicates that the risk associated with each windfarm project is high.

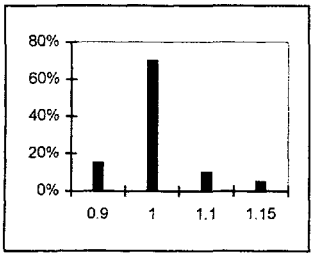
The results of the risk analyses of the Base Case are summarized as follows:

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
Expected EIRR (%)	13.1	13.1	12.3	7.7
Standard Deviation (%)	2.6	2.6	2.7	2.3
Minimum (%)	5.4	5.2	4.6	1.2
Maximum (%)	21.0	25.3	22.5	15.1
Probability – NPV (%)	34.0	34.0	48.0	96.0

2 In Monte Carlo simulation series of random numbers are generated following the distribution of each risk variable. For each simulation that represents a combination of different state of four variables, EIRR is calculated and recorded. From the distribution of the results of 1,000 simulations, the probability distribution of the EIRR can be estimated.

Figure 1

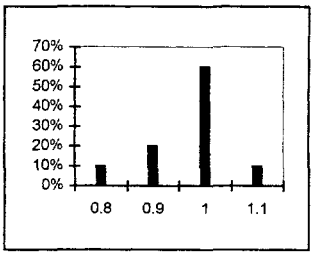
Risk Analysis Report of Huitengxile Windfarm



Risk Variable No. 1

Invest

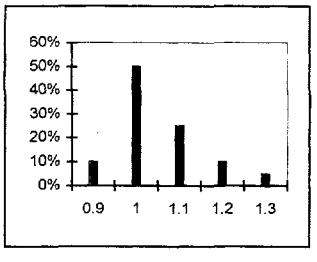
Probability distribution:			DISCRETE
15%	70%	10%	5%
0.9	1	1.1	1.15



Risk Variable No. 2

Generation

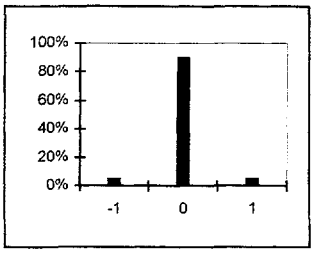
Probability distribution:			DISCRETE
10%	20%	60%	10%
0.8	0.9	1	1.1



Risk Variable No. 3

Tariff

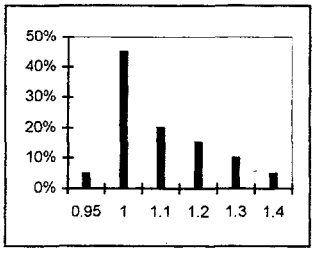
Probability distribution:				DISCRETE
10%	50%	25%	10%	5%
0.9	1	1.1	1.2	1.3



Risk Variable No. 4

Comm. date

Probability distribution:			DISCRETE
5%	90%	5%	
-1	0	1	

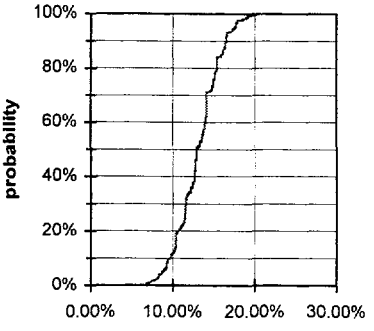


Risk Variable No. 5

Exchange Rate

Probability distribution:					DISCRETE
5%	45%	20%	15%	10%	5%
0.95	1	1.1	1.2	1.3	1.4

Cumulative Distribution of Eirr of Huitengxile Wind Farm



Frequency Distribution of Eirr of Huitengxile Wind Farm

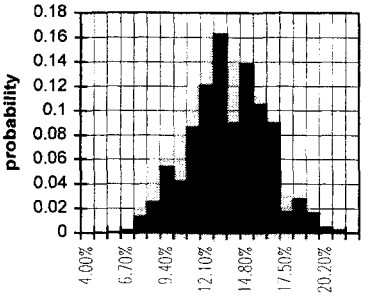
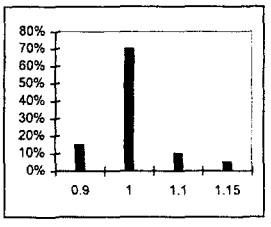


Figure 2

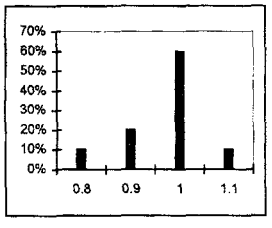
Risk Analysis Report of Zhangbei Windfarm



Risk Variable No. 1

Invest

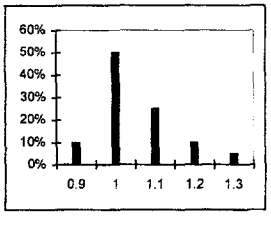
Probability distribution:				DISCRETE
15%	70%	10%	5%	
0.9	1	1.1	1.15	



Risk Variable No. 2

Generation

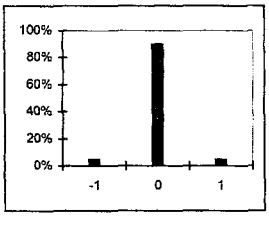
Probability distribution:				DISCRETE
10%	20%	60%	10%	
0.8	0.9	1	1.1	



Risk Variable No. 3

Tariff

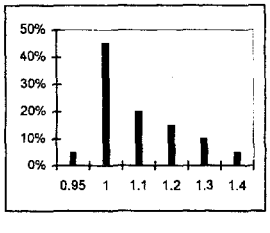
Probability distribution:					DISCRETE
10%	50%	25%	10%	5%	
0.9	1	1.1	1.2	1.3	



Risk Variable No. 4

Comm. date

Probability distribution:			DISCRETE
5%	90%	5%	
-1	0	1	

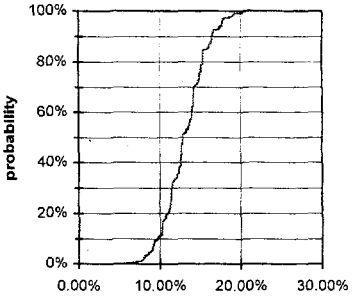


Risk Variable No. 5

Exchange Rate

Probability distribution:						DISCRETE
5%	45%	20%	15%	10%	5%	
0.95	1	1.1	1.2	1.3	1.4	

Cumulative Distribution of Eirr of Zhangbei Wind Farm



Frequency Distribution of Eirr of Zhangbei Wind Farm

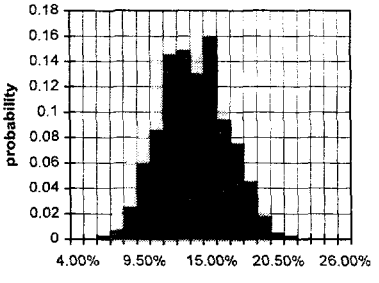
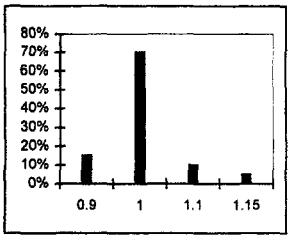


Figure 3

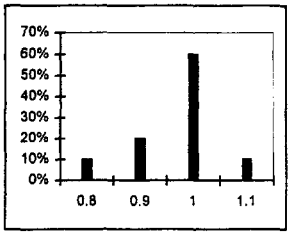
Risk Analysis Report of Pingtan Windfarm



Risk Variable No. 1

Invest

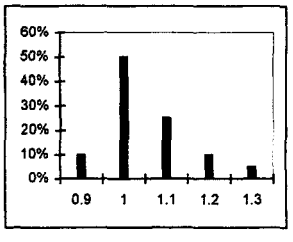
Probability distribution:			DISCRETE
15%	70%	10%	5%
0.9	1	1.1	1.15



Risk Variable No. 2

Generation

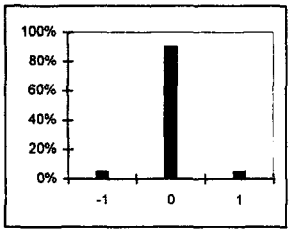
Probability distribution:			DISCRETE
10%	20%	60%	10%
0.8	0.9	1	1.1



Risk Variable No. 3

Tariff

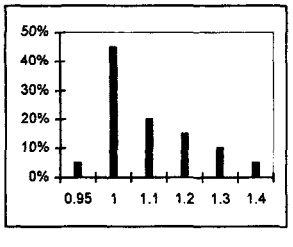
Probability distribution:				DISCRETE
10%	50%	25%	10%	5%
0.9	1	1.1	1.2	1.3



Risk Variable No. 4

Comm. date

Probability distribution:		DISCRETE
5%	90%	5%
-1	0	1

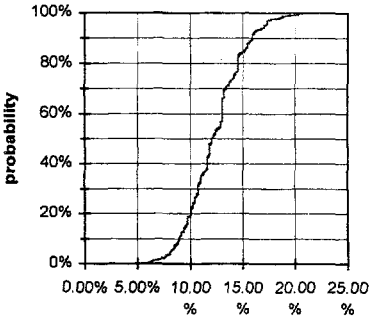


Risk Variable No. 5

Exchange Rate

Probability distribution:					DISCRETE
5%	45%	20%	15%	10%	5%
0.95	1	1.1	1.2	1.3	1.4

Cumulative Distribution of Eirr of Pingtan Wind Farm



Frequency Distribution of Eirr of Pingtan Wind Farm

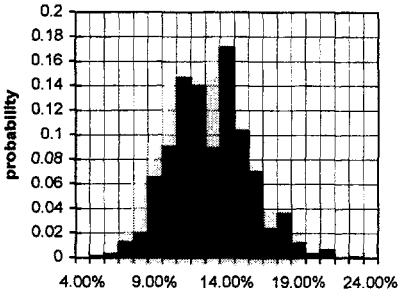
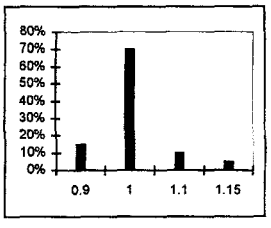


Figure 4

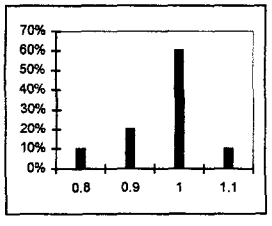
Risk Analysis Report of Chongming/Nanhui Windfarms



Risk Variable No. 1

Invest

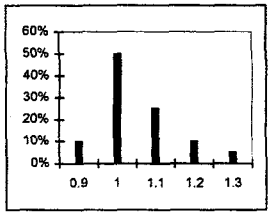
Probability distribution:			DISCRETE
15%	70%	10%	5%
0.9	1	1.1	1.15



Risk Variable No. 2

Generation

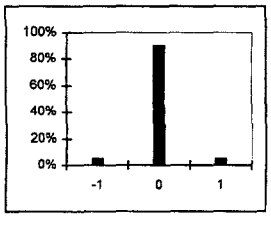
Probability distribution:			DISCRETE
10%	20%	60%	10%
0.8	0.9	1	1.1



Risk Variable No. 3

Tariff

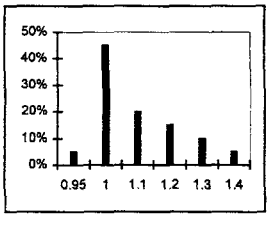
Probability distribution:				DISCRETE
10%	50%	25%	10%	5%
0.9	1	1.1	1.2	1.3



Risk Variable No. 4

Comm. date

Probability distribution:		DISCRETE
5%	90%	5%
-1	0	1

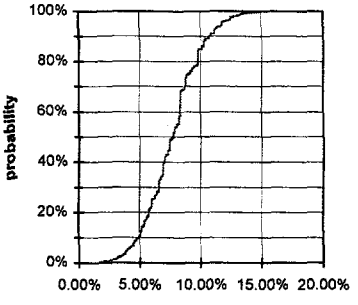


Risk Variable No. 5

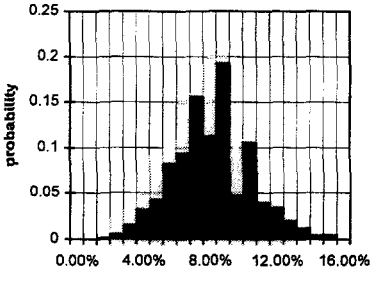
Exchange Rate

Probability distribution:					DISCRETE
5%	45%	20%	15%	10%	5%
0.95	1	1.1	1.2	1.3	1.4

Cumulative Distribution of Eirr of Shanghai Wind Farm



Frequency Distribution of Eirr of Shanghai Wind Farm



B. COST-BENEFIT ANALYSIS SUMMARY FOR SOLAR PV INVESTMENT

Least-cost was not carried out for the PV Component, as there are no viable alternatives in certain niche markets that are targeted by the Project. These niche markets are found in the northwestern provinces of Gansu, Inner Mongolia, Qinghai and Xinjiang, and adjacent areas of Tibet and Sichuan, where solar radiation is high, most rural households are without electricity, rural population densities are low, and there is a significant population of herdsmen that are seminomadic.

There were over 6,000 villages and more than 2 million households without electricity in these provinces in 1995. Population densities were the lowest in China, ranging from an average of 0.2 households per square kilometer in Qinghai to 2.3 households in per square kilometer in Gansu.[3] Households live in clusters that are grouped for administrative purposes into villages, but may cover tens and even hundreds of square kilometers. Many of the households are herdsmen, moving from their winter homes to summer homes on their grazing lands. The main PV system purchasers are households and institutions in dispersed communities that are distant from the main grid.

Providing electricity to these households is an important part of the GOC "8-7" program for poverty alleviation, but grid extension is not feasible because of the low population densities and long distances from existing grids. Gasoline and diesel generators are used minimally for productive purposes, because of the small requirements of individual households, the dispersion of the communities, and logistical difficulties in supplying fuel and maintenance. On the other hand, PV systems can be purchased by an individual household and require little maintenance. Household-scale wind systems are used extensively in Inner Mongolia, but wind resources are not adequate in many locations and are seasonal. Only PV and PV/wind hybrid systems can provide reliable and economically viable electricity for isolated rural households and institutions.

The willingness to pay for PV systems is being demonstrated in the marketplace, by the recent rapid expansion of system sales to rural customers in these areas. Seventeen companies participating in project preparation reported sales of 423 Wp in 1995 (17,600 systems), and 917 Wp in 1997 (44,600 systems), an increase of 117 percent in annual sales in two years. These companies are selling mainly small, portable systems for cash, to herdsmen families.

Reported sales in 1997 were already equal to over 40 percent of the project's average annual sales target of 2 MW, providing strong evidence of a solid market base for the project. However, poor system quality and after-sales service pose serious threats to the long-term sustainability of commercial development, as discussed in section C. While the project will assist the companies to expand existing markets, its main contribution would be to increase long-term sustainability by improving product and service quality and deepening the market by supporting development of payment mechanisms to make the systems more affordable.

A market study has been conducted to assist the project development by characterizing the potential purchasers of PV systems, their energy service demands, willingness to pay and preferred payment patterns.

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3 Based on an average of 4.5 people per household.

C. INCREMENTAL COSTS AND GLOBAL ENVIRONMENTAL BENEFITS

Broad Developmental Goals

In order to increase energy supplies to support continued economic growth while avoiding additional pollution-related impacts from coal burning, China would need to continue to improve energy efficiency and diversify away from its most abundant domestic energy resource: coal. Over the longer term, the only option for significantly reducing greenhouse gas emissions in China is an expansion of noncarbon energy sources. China has a large and expanding hydroelectric program, and has a growing nuclear power program under way in coastal provinces. To tap the full potential of renewable energy sources, China must adopt a new market-oriented development strategy and increase investment in research, development and demonstration of the most promising technologies.

The expansion of renewable energy technologies is essential not only for reducing the threat of global climate change, but also is a critical component of China's long-term energy supply for both local environment and poverty reduction reasons. Chinese cities are seriously polluted, with ambient air pollution concentrations commonly exceeding World Health Organization guidelines by three to five times. Recent analyses estimate that the annual health and agricultural losses associated with coal-related air pollution in China may be as high as 6 percent of GDP.[4] In addition to local environmental benefits, the Government of China is committed to renewable energy for rural development and for poverty alleviation. More than 100 million people in China currently depend on traditional biomass fuels for most of their energy needs, while more than 75 million people are without electricity. The Government has strongly supported small hydropower (<25 MW), biogas, and small wind machines over the past 35 years as a means of providing energy and electricity to dispersed and isolated rural populations. The 1995 Electricity Law and Renewable Energy Development Program extend government support for renewable energy from these technologies to solar, wind, geothermal and advanced biomass energy for heat and power.

Current Barriers to Renewable Energy Development

Despite large resource potential and government commitment, the contribution of renewable energy to China's current energy supply is small due to a number of market and nonmarket barriers. China's renewable energy program is made up of relatively small and uncoordinated efforts, mostly under the management of government research institutes, and has suffered from the lack of an overall strategy, market orientation, and relative isolation from the international community. Wind and PV have faced their own special barriers.

Grid-Connected Wind. Development of wind has remained at the small-scale demonstration level, which has contributed to the high costs of windfarms in China. Wind development has also been constrained by the lack of the legal framework (e.g., legal contracts, bidding documents) needed to attract commercial interest and competitive bids. In addition to the lack of scale economies and market competition, windfarm costs have remained high due to the lack of domestic component production. In other related industries, most notably thermal and hydro power, China has established a clear cost advantage over international suppliers through the development of a domestic industry. Windfarm development in China has been heavily dependent on bilateral assistance (for foreign exchange and/or import credits), which has limited the number of technology suppliers. While China has world-class wind resources, domestic and international investors are generally unaware of the large potential, as sites have not been adequately characterized, catalogued, and publicized.

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4 *Clear Water, Blue Skies: China's Environment in the 21st Century*, East Asia and Pacific Region, World Bank, 1997.

Solar PV. Despite the recent growth in demand for solar PV in China's western provinces among nomadic peoples, the scale of operations of PV companies has remained small and the quality of PV systems is low. System prices have been kept down by: (a) using poor-quality PV modules, (b) eliminating controllers, (c) setting distribution margins so low that maintenance and follow-up service are limited, and (d) by not fully accounting for overhead costs as many companies are offshoots of government institutes. PV companies sell locally made and uncertified PV modules, and many smaller systems are sold without controllers, which can shorten battery life and raise life-cycle PV system costs. PV companies have failed to establish efficient and extensive service networks, which has damaged the reputation of solar PV in China. The small, protected, and inexperienced nature of PV system companies, and the lack of familiarity with solar PV technology among the public and financial institutions, has severely limited the ability of solar PV companies to obtain commercial bank loans. This, in turn, has limited the commercial development of PV companies and their ability to expand into new markets, invest in technology innovation, and offer customers adequately size of systems due to the reliance on cash sales. The difficulty for consumers to obtain credit in China for consumer durable goods has been a further limitation on the development of the residential solar PV market and limited sales to small systems.

The Baseline Scenario

In the absence of the World Bank/GEF project, grid-connected wind and solar PV development in China would continue on its current trend.

Windfarm Development. Under the Baseline, windfarm development would continue to be relatively small (<20 MW), including many very small (<5M W) installations. Based on the current trend of government investments in wind, annual installed windfarm capacity under the Baseline would be on the order of 20-40 MW, or a total of around 150 MW over a five-year period. The development of windfarm installations would be largely noncommercial demonstration efforts, led by government research institutes and/or state-owned companies. More than 90 percent of wind turbine and associated equipment would be imported, and foreign exchange financing would be largely through tied bilateral aid. The installed and levelized costs of windfarms would remain above international levels (more than $1,300 per kW installed and 7.5 US cents/kWh), and would also remain significantly higher than domestic power alternatives, such as coal-fired thermal power (about $600/kW and 4.0 cents/kWh) and hydroelectric (about $900/kW and 5.0 cents/kWh). *Total investment costs under the Baseline would be about $195 million (150 MW at $1,300/kW).*

Solar PV development would proceed in China's poorer and remote provinces due to the large number of unelectrified households in these regions and the attractiveness of solar PV in filling this need.[5] In the absence of the GEF project, (a) solar PV system quality would remain low; (b) distribution and service networks would remain underdeveloped, and (c) PV companies would remain small, relatively uncommercial and forced to rely on parent research institutes, and would continue to sell small systems. Under the Baseline, solar PV companies have essentially no access to working capital loans from domestic banks, and operate entirely on the basis of cash sales. Based on current trends, over the five-year period from mid-1999 to 2004, the scale of development in the targeted provinces would be approximately 250,000 systems, dominated by 20 Wp systems, and a total installed capacity of around 4.6 MW. The average cost of such systems would be about $11/Wp. *Assuming a similar scale of*

[5] During the past two years, solar PV development in China's Qinghai province has begun to develop rapidly. Supported by a number of provincial and national government programs, a nascent market for solar PV has been developing, chiefly among the region's nomadic herdsman. A number of small companies have begun to assemble and sell small (10-20 Wp) systems on a cash basis, some without direct government subsidies.

development as under the GEF Alternative, the total costs of the Baseline would be $110 million (see Table 1 below).

Technology Improvement. Since 1996, the Chinese government has been encouraging technology improvement for wind turbines and components by requiring international technology suppliers to establish joint ventures in order to be eligible to apply for contracts. It has also mandated that a certain percentage of equipment be procured from domestic suppliers. For most projects, these requirements have had to be dropped in order to proceed with the investments, and overall these policies have not led to significant local manufacturing of windfarm equipment domestically. Technology development for solar PV has not advanced as far in China as wind. A few joint ventures to produce PV modules have been established, but the technology is outdated, production is inefficient, and the costs are relatively high. Many of the components are being produced in China (batteries, bulbs); however, most are not suitable for solar PV use and failure rates are high. Funding for all renewables during the Ninth Five-Year Plan (1996-2000) by SSTC amounts to Y 100 million ($12 million): of which, about 25 percent ($3 million) is for wind, and 20 percent for solar ($2.4 million). Because there has been limited success in transferring windfarm and solar PV technology to China, the Baseline expenditures by industry are assumed to be minimal. *Baseline expenditures for technology improvement is estimated to be about $3 million for grid-connected wind and $2 million for solar PV, for a total of $5 million.*

Institutional Support. Under the Baseline, windfarm development would continue to be led by government agencies, financed by government grants and bilateral assistance. Windfarm projects would continue to be prepared one by one. Wind resource mapping, showing high-potential regions, would take place under the Baseline under a UNDP GEF TA project. Some individual provinces would begin to establish their own standards for solar PV; however, this would create confusion for suppliers and customers, and could create unintentional barriers to provincial trade of solar PV modules and components. There would be no coordinated or systematic national testing or certification of PV modules or components. Based on estimates from SETC, current spending during the Ninth Five-Year Plan on these types of TA for windfarms and solar PV are on the order of Y 40 million ($5 million). *Total expenditures under the Baseline on institutional support for windfarms and solar PV are estimated to be about $5 million.*

Summary. China's windfarm and solar PV programs would continue under the Baseline, though at a much slower pace than under the GEF Alternative. Over the coming five years, approximately 150 MW of new windfarm capacity and an additional 4.6 MW of solar PV are likely to be added in China under the Baseline. The scale of individual windfarms would remain too small to significantly lower costs, and to attract longer-term commitment to wind power by international windfarm developers. For solar PV, the low quality of PV systems will damage further development of the technology, as will the lack of an extensive service network among PV suppliers. Under the Baseline, solar PV companies remain too small, and financially too weak, to improve quality and service and broaden the nascent market for PV in northwest China. Money or trade policies by the Government to support technology improvement would remain limited, benefit a small group of domestic companies, and do little to support long-term technology transfer and innovation of wind and solar PV technologies in China. Neither windfarm companies, nor their employees, would gain commercial experience. No pipeline of follow-up projects would be prepared that could allow rapid development of additional sites by nonutility equity investors. The technical and financial experience of China's currently operating windfarms would not be collated and made available to potential investors. Under the Baseline, no national standards for solar PV would be developed. *The total costs of the Baseline are estimated to be around $315 million.*

The GEF Alternative

What is needed to spur renewable energy development in China is a new market-driven approach that: (a) lowers costs and improves quality for commercial or near-commercial renewable energy applications; (b) increases the scale of development by stimulating the market for renewables; and (c) combines international advances in renewable energy technology with demonstrated Chinese low-cost production capabilities. The GEF Alternative will expand the scale of both wind and solar PV development in China, adding 190 MW of grid-connected windfarm capacity and the sale of about 10 MW of high-quality PV systems (an estimated 350,000 to 400,000 systems) by commercially oriented companies.

Windfarm Investment. Initial barriers to windfarm development will be addressed through a large-scale windfarm investment financed by IBRD loans and government cofinancing. Under the project, the increased size of windfarm contracts and competitive bidding are expected to significantly lower the installed cost of windfarms in China. By establishing government commitment to long-term wind power development, developing model contracts, preparing a pipeline of potential future projects and strengthening the capacity of domestic windfarm companies, the project will seek to attract foreign and domestic interest for future nonutility equity participation in windfarm development in China. In order to further lower windfarm costs and reduce foreign exchange requirements and potential impacts of currency fluctuation, the project will promote indigenous technology improvement, which has been shown to significantly reduce supply costs in related industries in China (see below).

Under the GEF Alternative, a total of 190 MW of windfarm capacity would be installed and an additional 200 MW of windfarm investment projects would be prepared by the project. It is expected that 50 MW of capacity would be installed with no connections to the project, for a total of 440 MW. Based on the lower costs of installed windfarm capacity achieved through the project (see paragraph below), it is estimated that an additional 250 MW would be installed in China by the year 2004. Direct and indirect windfarm capacity additions under the GEF Alternative would, therefore, be 290 MW more than compared to the Baseline of 150 MW.

The total costs of installing 190 MW of grid-connected windfarm development in China is estimated to be around $203 million, of which World Bank loans would finance the foreign exchange costs of $100 million, while domestic cofinancing would cover the remaining costs. The unit cost is significantly lower than under the Baseline Scenario, at $1,050 per kW rather than $1,300, because of the use of ICB and economies of scale. However, wind power is still more expensive than power from coal. For comparison, the costs of a 190 MW thermal power plant would be less than $140 million, or about $740 per kW. While wind is preferable for local environmental reasons, a coal-fired plant would have other noncost advantages over wind, such as dispatchability.

Solar PV Investment. The strategy for solar PV development is to tap the growing market potential in four remote provinces by: (a) improving the quality of PV systems, (b) encouraging the establishment of sales and service networks, and (c) strengthening the financial, technical and managerial abilities of qualified solar PV companies in China. Solar PV companies will be supported to sell approximately 10 MW, about 350,000 systems, in Gansu, Inner Mongolia, Qinghai, Xinjiang, Tibet, western Sichuan and adjacent areas. Participation will be open to solar PV companies throughout China that agree to market high-quality PV systems, offer warranties and service in the project provinces, and that are financially sound, motivated and commercially oriented companies. Companies have been and will continue to be preselected to participate in the project based on their ability to demonstrate that they can meet the general market goals outlined above.

Companies that participate in the project are required to: (a) offer a comprehensive consumer protection package, including warranties and adequate after-sales service; (b) use equipment and components that are

certified to meet the project's quality standards; (c) agree to abide by a company conduct code for good customer service; (d) agree to establish an escrow account, based on the GEF grant due to the company, to be used solely to assist customers with complaints; and (e) provide the operational and financial information required by the PMO for project monitoring and evaluation.

The GEF Alternative would provide direct grant support to the companies participating in the project, to assist them to meet the above requirements for improved products and service. It would also include a Market Development Program, to be implemented by SETC. This program would provide support needed to overcome market barriers and strengthen the commercial capabilities of PV companies, including: (a) a public information campaign to give consumers objective information about PV system performance and costs; (b) training staff of PV companies in accounting, financial management, marketing, after-sales service, etc.; (c) a study of possible mechanisms for consumer financing or other mechanisms to increase affordability, development of an action plan, and follow-up financial support, if justified; and (d) support for market monitoring, obtaining feedback from consumers and companies, and consumer protection.

The GEF Alternative is expected to improve solar PV product quality in China, while maintaining cost levels that are low by international standards, by: (a) expanding the PV market, and (b) introducing advanced module manufacturing technology and better balance of system component designs and production (see section on technology improvement). Initial support from the GEF is needed to improve the quality of solar PV systems in China to acceptable and sustainable levels, assist qualified solar PV companies improve their distribution and service networks, and grow into commercially oriented companies. The costs of improving solar PV systems to levels necessary to sustain long-term development are estimated to cost on average about $13/Wp (see Table 2 below). Over time, as the market expands, companies become stronger and larger, and domestic manufacturing improves, system costs are expected to be reduced (see Figure 1). *The total costs of the solar investment component under the GEF Alternative are estimated to be about $130 million* (see Table 1).

Technology Improvement. As demonstrated in China over the past 20 years for related technologies, indigenous production is the key to lowering installed costs of wind power in China. In the thermal power sector, the costs of a domestically produced 300 MW unit are typically 20-30 percent less than a typical international unit, assuming similar environmental controls. At present, only towers are being procured domestically, accounting for only about 10 percent of total installed costs. Other wind power components (generators, gearboxes, blades, inverters), which are currently being produced in China for other purposes, could be produced domestically with only modest modifications to existing production lines. Because the majority of international wind turbine companies are relatively small, and given the vagaries of the international market for wind, it is difficult for them to allocate the necessary capital for prototype development. Major wind companies are system integrators, acquiring their components from a number of suppliers. Most of their excess funds go into research and development, leaving little capital to finance manufacturing facilities in countries where markets are still unclear.

The India Renewable Energy Project used tariffs to encourage the production of wind power equipment domestically. While many of the components were ultimately produced in India, the costs of such components never fell below international levels. In China, the Government has taken a different course and has recently eliminated all import tariffs and duties for wind and solar energy. The intent is to promote renewable energy, acquire advanced international technologies, and encourage domestic competition with foreign suppliers for both quality and price. To further hasten the domestic production of wind and solar equipment, which is essential to lowering the costs of these technologies in China, a technology improvement component is being proposed.

Technology Improvement for Wind. The overall goal of the program would be to increase local manufacturing of components to a level sufficient to reduce costs and foreign exchange requirements,

thereby guaranteeing a sustainable domestic wind power industry. Based on technology improvement programs in the Netherlands and elsewhere, a competitive and cost-shared program with industry is proposed that would fund promising proposals for reducing the costs of wind power components. Proposals would be prepared by domestic firms, or by Chinese-international joint ventures, and would be selected based on the demonstrated ability to lower production costs. Support could be considered for production of prototypes, technology licensing, and consulting services for design or manufacture.

The goal of the GEF Alternative is to enable China's wind turbine industry to manufacture components accounting for about 70 percent of the costs of a windfarm by the year 2004. At this level, it is estimated that windfarm development in China could be sustainable, both in terms of lower installed costs relative to domestic alternatives, and foreign exchange requirements. The Chinese Government and industry are expected to contribute substantially to the technology improvement program for wind. *The total additional cost of investment in the technology improvement component for wind energy under the GEF Alternative is estimated at $54.6 million.*

Technology Improvement for Solar PV. This component would help improve component quality through introduction of advanced module manufacturing technologies and better balance of system component designs and production. In the United States, a similar program to hasten technology innovation in PV module production helped reduce module costs by 50 percent in five years. This program also helped companies to optimally integrate system components to improve performance and reliability, and increase lifetimes. A competitive program to support production of solar PV equipmentis proposed to be supported under the project. Proposals would be accepted for cells, modules and balance-of-system (BOS) components, with the intention of improving technology quality and lowering domestic supply costs. The immediate aim would be to accelerate the movement of module costs and quality to international levels. It is expected that PV module costs could be reduced by almost 20 percent. Significant declines in costs are expected from domestic production of other components, including batteries, controllers and inverters. Because the other components also account for the majority of system repair problems, ensuring the quality of these components would be a major objective of the program. The goal of the GEF Alternative is for domestically produced balance of system components for solar PV to meet international standards by the end of the project, and for 75 percent of modules to be produced domestically. *The total additional cost of the investment in the technology improvement component for PV under the GEF alternative is estimated to be $23.4 million.*

In summary, the total cost of the investment part of the Technology Improvement Component is $83 million, including $5 million from the baseline and the additional investment of $78 million for investment in wind ($54.6 million) and PV ($23.4 million).

Financing Arrangements for Technology Improvement. The original costs of a technology improvement program to reach the above goals were preliminarily estimated at around $30 million, of which $20 million was proposed for windfarm equipment and $10 million for solar PV. The original proposal in the Project Concept Document was that this would be financed by a $10 million grant from GEF, an equal grant from SETC, and the same amount from industry. However, SETC has instead proposed to substitute $50 million in concessional loans under its Technical Retrofitting Program (subsidy up to half commercial interest rates), for its proposed grant contribution. While this reduces the amount of grant funding, it would provide an important linkage to commercial viability by enabling companies to invest in production equipment for commercial production of improved technology. Also, the need for institutional strengthening for technology improvement has resulted in the proposed reallocation of $1 million in GEF grant financing to these activities (see institutional strengthening below.) Therefore, proposed financing for the technology improvement investment component is $9 million from industry as matching contribution for proposed $9 million in GEF grants, plus an additional $10 million in equity from industry and $50 million in concessional loans from commercial banks to industry, for a total of $78 million.

Institutional Strengthening. Under the GEF Alternative, institutional strengthening would be provided to support the windfarm, solar PV, and technology improvement components.

Wind. The following are the key institutional strengthening components for windfarms.

- **Private Sector Development of Windfarms in China.** This task would assist in: (a) developing a strategy to encourage private-sector development of windfarms; (b) preparation of investment packages for one or two large windfarm sites (several hundred MW) through private-sector financing; and (c) capacity building of staff of SP, the windfarm companies, and other local investors on technical, legal, financial, and contractual requirements for obtaining private investment. The second activity would include carrying out technical work, preparing legal and contractual documentation, presenting the resulting packages to potential investors, and assisting in the tendering process *(total costs are estimated at $3.6 million)*.
- **Collection, Analysis, and Dissemination of Performance Data for Windfarms.** This activity would assist in the publication of an annual report on China's windfarms. The information would help gauge the technical performance of the windfarms and would provide critical information to prospective investors and lenders *(total costs are estimated at $300,000)*.
- **Financial Management and Organizational Structure Assistance.** This activity would provide TA and training to ensure that the new windfarm companies would have adequate financial management and accounting systems as well as a sound organizational structure, to ensure commercial orientation and future access to financial markets *(total costs are estimated at $1 million)*.
- **Engineering, Construction Management, and O&M Management Services.** This activity would assist the windfarm companies to establish the capacity to build, operate and maintain windfarms *(total costs are estimated at $700,000)*.
- **Capacity Building.** This activity would support institutional strengthening of staff of SP, the windfarm companies, or other parties to address technical, policy, and/or institutional issues associated with wind power *(total costs are estimated at $400,000)*.

Solar PV. The capacity building for solar PV would have two main activities:

- **Product Quality Assurance.** This activity would include: (a) establishing national PV testing and certification centers; (b) establishing national PV component and system standards; and (c) improving quality control procedures of PV equipment suppliers *(total costs are estimated at $2 million)*.
- **Project Implementation and Management.** Project implementation support would be provided to the PMO and PIUs for management, monitoring, and audits to verify installations and solar PV company performance. These units would also be primarily responsible for tracking the project performance indicators and GEF-specific monitoring and evaluation *(total costs are estimated at $2 million)*.

Technology Improvement. The proposed additional capacity building would include: (a) program management, including monitoring and evaluation, and preparation of the annual plan; and (b) institutional strengthening activities such as improving capacity of staff in manufacturing companies in areas such as contracting and legal aspects of technology transfer agreements, and carrying out special studies needed to better implement the project *(costs are estimated at $1.6 million)*.

Global Environmental Benefits

The project is estimated to directly displace about 13 million tons CO_2 emissions. The direct incremental environmental benefits are estimated to be 6.2 million tons CO_2.[6] More importantly, through commercialization and the lowering of wind and solar PV technology supply costs, the project will help accelerate the development of renewable energy. An additional 250 MW of wind projects will be installed in China by the year 2004, of which 200 MW will be prepared during the project. As a result of the preparation of additional windfarm sites, and lower unit costs achieved through the project, indirect incremental environmental benefits are estimated to be an additional 11 million tons of CO_2 by the end of project in 2004 (indirect 250 MW). The total incremental environmental benefits are, therefore, 17.2 million tons CO_2 (indirect incremental environmental benefits for PV are not quantified).

The market potential for solar PV is also large. Of the 75 million people without electricity in China, the majority are located in isolated regions where solar PV would provide the least-cost energy source. Total solar PV potential for unelectrified households is around 800 MW. When considering underelectrified households, and the use of solar PV for residential or commercial peak-shaving, the long-term demand for solar PV could be at least as high if not higher.

Additional Domestic Benefits

In addition to global environmental benefits, the project would result in significant reduction in the emissions of particulates, sulfur, and nitrogen (see Annex 1 for targets.)

Incremental Costs

The incremental cost is $112.6 million (see Table 1). This is broken down by component as follows:

For the windfarm component, the incremental cost is calculated to be $8 million. This incremental cost will be borne by the windfarm companies. *No GEF assistance is requested for the wind investment component.*

At the end of the project the sale of PV systems in the target provinces is expected to be entirely on a commercial basis, reflecting the expected fall in system costs through an expansion of the PV market and increased competition (see Figure 1). The GEF grant is proposed to decline over the course of the project. *The total incremental cost of barrier removal for raising system quality is estimated to be about $2/Wp for the solar investment component, or a total of $20 million (see Table 2).*

The difference in cost between the Baseline and the GEF Alternative for technology improvement is estimated to be $78 million. The major part of this cost differential will be covered by industry, while GEF resources are required to initiate and stimulate this process. *GEF incremental cost funding for the technology improvement component for both wind and solar PV amounts to $9 million.*

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6 In the without case, 150 MW wind will be installed with an average capacity factor of 20 percent. In the GEF alternative, 190 MW wind will be installed with an average capacity factor of 25 percent (conservative estimate, see Annex 2). The difference in electricity generation is in the without case assumed to be generated in coal-fired power plants (3 million MWh). For PV, the without case assumes an installation of 4.6 MWp of PV, which will replace kerosene consumption for lighting. Of the 4.6 MWp, 2.3 MWp (50 percent) is assumed to be in operation only for five years, after which the consumers who are dissatisfied with the poor quality and unreliability of the PV system will revert back to kerosene. The remaining 2.3 MWp will remain in operation for 20 years, by replacing necessary components as needed. In the GEF alternative, 10 MWp high-quality PV will be available for 20 years to displace kerosene. The incremental benefit is the difference in avoided CO_2 emissions, which amount to 3.0 million tons CO_2.

An important difference between the Baseline and the GEF Alternative is support for institutional strengthening, which is viewed as a critical aspect of sustainable renewable energy development in China. This difference is $6.6 million, of which $0.6 million will be covered by SETC. *The GEF incremental cost funding for institutional support, project management, and GEF monitoring and evaluation is $6 million.*

Due to the cost-sharing arrangements outlined above, incremental cost funding requested from the GEF amounts to $35 million out of the total cost differential between the Baseline and the GEF Alternative of $112.6 million. A detailed presentation of domestic benefits, global benefits, component costs, and estimated incremental costs is presented in the Incremental Cost Matrix *(Table 1).*

Table 1: Incremental Cost Matrix

	Baseline	Alternative	Increment
Domestic Benefits	• A given level of electricity is provided by windfarms and off-grid solar PV • Cost of electricity from windfarms remains above international levels. • Quality of solar PV systems is low, service is low, solar PV companies remain small and uncommercial. • Little indigenous development of windfarm and solar PV technologies.	• Barriers to commercial development of windfarms and solar PV removed. A greater amount of electricity is generated by windfarms and solar PV. • Costs of electricity from windfarms fall; costs of high-quality solar PV systems fall. • Technology development in China proceeds lowering domestic costs for wind and solar PV • Institutional strengthening to support commercial development of wind and solar PV	• Barriers to commercial development removed. • Additional 3,066GWh and 214GWh of PV is generated over a 20 year period. • Technology transfer proceeds for windfarms and solar PV. • Institutional capacity for commercial windfarm and solar PV strengthened.
Global Environmental Benefits	No GHG emissions associated with the provision of above level of electricity from wind and solar PV.	No GHG emissions associated with the provision of above level of electricity from wind and solar PV. Higher level of renewable energy provided than under the Baseline.	• 17.2 mt of CO2 reduced (6.2 direct, 11 indirect) • Costs of windfarms and solar PV reduced.
Costs by Component (million $)			
Wind Investment	195	203	8
Solar PV Investment	110	130	20
Technology Improvement	5	83	78
Institutional Support	5	11.6	6.6
Total Costs	315	427.6	112.6
Additional Contributions:			
GOC and Industry			77.6
GEF Incremental Costs			35

Table 2: Solar Development, 1999-2004

	1999/a	2000	2001	2002	2003	2004/a	1999-2004
Baseline Scenario							
Number of Systems	20,000	45,000	50,000	55,000	60,000	32,000	262,000
Capacity (kWp)	380	855	900	935	990	512	4,572
Per Unit Cost ($/Wp) /b	10.50	10.80	11.00	11.05	11.10	11.10	11.00
Total Cost ('000 $) /c	5,239	14,429	19,250	25,327	30,514	15,263	110,002
GEF Alternative							
Number of Systems	22,035	52,626	62,232	76,121	83,733	41,866	338,613
Capacity (kWp)	532	1,401	1,804	2,363	2,599	1,299	9,998
Per Unit Cost ($/Wp) /b	15.16	14.65	14.07	12.73	12.07	11.82	13.04
Total Cost ('000 $)	8,065	20,525	25,382	30,081	31,369	15,354	130,776
Incremental							
Per Unit Incremental Cost ($/Wp)	4.66	3.85	3.07	1.65	0.97	0.72	2.08
Total Incremental Cost ('000 $)	2,826	6,096	6,132	4,754	855	91	20,774

/a Half year only.
/b Weighted average.
/c Total costs are standardized using the same scale of PV development (kWp) as under the GEF Alternative.

Annex 6: Evaluation of the Project Financial Management System

China: Renewable Energy Development Project

In accordance with the Bank OP/BP 10.02 and the Guide for Review and Design of Accounting and Reporting System for World Bank Projects, the task team (Chau-Ching (Tony) Shen, Financial Management Specialist, EACCF) has reviewed plans, procedures and guidelines for establishing a Financial Management System with the Project Management Office (PMO) established by the State Economic and Trade Commission (SETC), and State Power Corporation of China (SP) for the Renewable Energy Development Project (the Project). The financial management capacity of the Project will be strengthened through training, provision of equipment and recruitment of qualified financial staff. It was noted that some of the project staff from SETC and SP have had prior experience with the Ministry of Finance's and the World Bank's requirements and procedures in preparation and processing of withdrawal application and disbursement of funds.

As a result of assessment of project financial management system, the following arrangement was made and agreements were reached with SETC and SP respectively.

A. THE FINANCIAL MANAGEMENT SYSTEM—WINDFARM COMPONENT

As all four entities under windfarm component will be newly established companies (either as limited-liability companies or joint-stock companies) formed between provincial power companies and SP or other third entity, it is crucial to establish a sound and strong institutional capacity for the financial management. The task team has recommended and SP agreed that the following actions be taken before these new companies commence their operations.

Staffing and Training

Though it is expected that some of the staff required for the operation of the new companies will be seconded from the respective parent power companies, an adequate number of qualified financial staff should be recruited before commencement of operation. The chief accountant to be hired for each windfarm company should have adequate experience and credentials in financial and accounting management. In addition, they should be able to maintain books of accounts, exercise adequate internal controls, safeguard the company's assets, monitor progress of the Project and produce financial information and statements required by the Bank. We have been advised that the positions of chief accountants will be filled with qualified personnel before project commencement.

Well-defined roles and responsibilities should be supplied for key financial officers of the respective companies and SP. Per review of project financial management procedures and guidelines prepared by SP, the task team noted that general guidelines have been provided in respect of the financial/accounting positions. (See "Financial and Accounting System" for further discussion on project financial management procedures and guidelines.)

Training should also be provided as and when needed to ensure sound accounting practices and financial reporting of project expenditures and other financial transactions. The Bank plans to readdress major areas of project financial management during the Project's launch workshop.

Financial and Accounting System

In view of the fact that project companies will be established as limited-liability or joint-stock companies, accounting standards for joint-stock companies issued by the Ministry of Finance (MOF) in January 1998 will be used by these companies as the basis for bookkeeping and preparation of financial statements.

Such accounting standards are closely modeled after the International Accounting Standards and are acceptable to the Bank.

In addition, in order to keep track of activities at the project level, "Temporary Regulations on Financial and Accounting Management for Projects Financed by the World Bank" (Circular 127, 1993) issued by MOF will be used as a basis for bookkeeping and preparations of project financial statements and management reports. The Circular was geared toward infrastructure-oriented projects. Accrual accounting and double-entry basis will be adopted by participating companies and the Project; each originating party will maintain ledgers, journal vouchers and original supporting documents.

Project financial management procedures and guidelines, which have been prepared by SP with assistance from the Bank task team, provide procedures and guidelines for major areas of operations, and will be made available to staff before commencement and used as a guide in the operations.

Internal and Other Controls

SP should prepare and make available to related staff a set of detailed guidelines on policies and procedures of financial/accounting management to ascertain accurate accounts of project activities in a timely manner. Per review of the project financial management procedures and guidelines mentioned above, we note that sufficient controls have been designed for the project and included the following features:

- a system of authorization, verification, reconciliation, record procedures and project reporting adequate to provide reasonable control over project costs, security of assets, schedules and technical performance
- delegation and segregation of duties
- timely and accurate financial reporting requirements.

Reporting Requirements

The format and content of the following reports have been discussed with and agreed to by the Project. Reports are required to be submitted to the Bank within 2.5 months after the close of each reporting period (i.e., September 15 and March 15):

Financial statements (biannual basis)

- Balance sheet
- Statement of sources and uses of funds by project component
- Statement of implementation of loan/GEF grant agreement
- Special account statement.

The above project financial statements represent the standard project financial reporting package agreed to between the Bank and MOF and will apply to FY99 projects. Each of the participating companies (i.e., four windfarm companies and SP) will manage, monitor and maintain their respective project records and accounts, and submit to the Bank their respective financial reports. No consolidated project financial statements will be required.

Auditing Requirements

The Bank requires the Borrower to have its annual financial statements audited in accordance with standards acceptable to the Bank. Audit arrangements for the project will be similar to other Bank-financed projects in China whereby National Audit Office and its authorized agencies will be designated as auditors for the Project.

Audit reports on project annual financial statements of the following should be submitted to the Bank within 6 months after the end of each reporting year, with a separate opinion on statements of expenditures and the special account:

- four respective windfarm companies (to be audited by respective Provincial Audit Bureaus)
- SP project accounts (to be audited by National Audit Office).

In addition, SP is required to perform regular check on the four entities; Bank task team will also audit the books on a spot check basis as and when deemed necessary.

Budgeting

SP and the operating companies will develop an annual budget plan and use it to monitor financial and operational progress of the companies.

Special Account Management

SP will manage the special account for the GEF grant. Since MOF has already established procedures to apply for payments and for replenishments of funds, SP should work closely together with MOF in setting up policies and procedures for the Project to ensure efficient and accurate fund management and timely disbursements. In addition, the Bank stands ready to provide training and assistance as and when needed to facilitate withdrawal applications.

B. THE FINANCIAL MANAGEMENT SYSTEM—PV AND TECHNOLOGY IMPROVEMENT COMPONENTS

SETC, a government agency, is one of the beneficiaries of the GEF grant and is responsible for implementing the PV and Technology Improvement (TI) components of the Project. Separate sets of records and accounts will be maintained for the PV and TI components. The arrangements outlined below apply to the PV component. The TI component will follow similar arrangement.

As PV participating companies are numerous and not sophisticated enough in keeping books or accounting records in line with standards acceptable to the Bank, it is critical that a sound institutional capacity for financial management be established to ensure smooth operations and success of the project. To date, the PMO has on several occasions provided financial training to PV participating companies and such training is expected to continue throughout the life of the Project.

The Bank task team has also recommended and SETC's PMO agreed that the following be put in place before commencement of the project:

Staffing and Training

Though a PMO has been set up for the project, various departments within the PMO should be adequately staffed with qualified personnel. A well-defined organization chart of the PMO has been developed. The chief accountant to be employed should have adequate relevant experience and credentials in financial and accounting management to ascertain the accuracy, completeness and integrity of information collected, processed and distributed throughout the project.

The task team has been working closely with the Project in identifying suitable candidates to be considered for various positions, including chief accountant and contract manager. It is expected that PMO will be staffed with qualified personnel before commencement.

Sufficient training is critical to the success of the component. A well-designed training plan has been developed for the PMO and participating PV companies to ensure that staff/companies have the skills

required for the work involved. Detail job description and operations manual/procedures should be made easily accessible to all project staff involved to guide in the accounting practice and financial preparation and reporting. The task team has provided the PMO a sample project financial management manual, which covers all major areas of operation, such as cash/fund management, financial/accounting management, procurement management, withdrawal applications and asset management. The PMO has agreed to follow the sample manual and further tailor it to the specifics of the components and issue it before commencement to all staff involved in the operations for guidance and reference.

Financial and Accounting System

In order to participate in the project, the PV companies are required to provide annual audited financial statements, which are in full compliance with Chinese standards.

In addition, in order to keep track of activities at the project level, "Temporary Regulations on Financial and Accounting Management for Projects Financed by the World Bank" (Circular 127, 1993) issued by MOF will be used as a basis for bookkeeping and preparation of project financial statements and management reports. The Circular was geared toward infrastructure oriented projects. Accrual accounting and double entry basis will be adopted by participating PV companies and the Project; each originating party will maintain ledgers, journal vouchers and original supporting documents.

As financial and accounting data to be collected and processed (SETC/PMO in particular) are fairly diverse and complicated, a well-defined computerized information system is strongly recommended for the SETC/PMO. The task team further noted that a software development company has been contracted by PMO to design a management information system for the components, which is expected to be fully operational by June 30, 1999.

Internal and Other Controls

Due to the vast quantity of information to be collected and processed, efforts should be taken by the PMO to develop a set of well-defined guidelines on policies and operating procedures and distribute it to the staff involved. The task team has advised the PMO that project financial management manual to be developed should closely follow the sample copy provided by task team so that sufficient controls can be built into all major areas of operation and include the following control features to ascertain accountability of project activities:

- a system of preparation, verification, authorization, reconciliation, record procedures and project reporting adequate to provide reasonable control over project costs, security of assets, schedules and technical performance
- delegation and segregation of duties
- timely and accurate financial reporting requirements
- personnel of a quality commensurate with their responsibilities.

In addition, per discussion with PMO staff involved in the design of the management information system and review of system needs analysis, the task team noted that sufficient controls have been built into system design.

Reporting Requirements

PV Companies. The main approach to the participating PV companies' reporting requirements under the project is that they should be the minimum necessary to verify sales and installations for which GEF payments are made and to monitor PV market development. The following reports have been agreed with the companies and will be submitted on a quarterly basis within one month after the end of each reporting period to the PMO:

- Statement of Sales and Purchases
- Statement of unit PV sales by Wp size and province.

In addition, the companies are required to submit annual audited financial statements, preferably within three months but no longer than six months after the close of fiscal year.

SETC/PMO. On a biannual basis (i.e., before September 15 and March 15), SETC/PMO will prepare and submit to the Bank the following for PV and TI components respectively:

Project Financial Statements

- Balance sheet
- Statement of sources and uses of funds by project component
- Statement of implementation of the GEF grant agreement
- Special account statement

The above project financial statements represent the standard set of project reporting package agreed to by MOF and the Bank, which will apply to all FY99 projects in China. The audited annual project financial statements should be accompanied by copies of annual audit reports of all participating PV companies.

Monitoring Reports

The PMO will also issue a biannual monitoring report[1] (before September 15 and March 15) containing:
- report on GEF grant payment submitted, by companies, received and authorized by PMO;
- end-user verification audits completed, by company and province;
- summary report on total solar home system (SHS) unit and Wp sales, by company, Wp and province;
- results and status of customer surveys, focus group sessions and other activities under the Market Development Program or Quality Assurance Programs;
- recommendations for adjustments to improve implementation performance.

Annually, the PMO will issue a summary report on the financial performance of the participating PV companies. This report will include consolidated financial performance information of the companies compared with the financial performance indicators. This report should be submitted to the Bank within 6 months of the reporting year-end.

Auditing Requirements

The National Audit Office has been identified as auditors for the PV and TI components. Audit reports on annual financial statements of the components should be submitted to the Bank within 6 months after the end of each reporting year, with separate opinions on statements of expenditures and the special account.

Budgeting

The PMO will prepare annual development work program to monitor progress of the project and use of funds.

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1 This monitoring report will be required initially on a biannual basis but may be required on a quarterly basis if necessary.

Special Account Management

SETC will manage the special accounts for the GEF grant. Since MOF has already set up procedures for payments and replenishment of funds, the PMO should work closely together with MOF in establishing policies and procedures for the Project to ensure efficient and accurate fund management and timely disbursements. In addition, the Bank stands ready to provide training and assistance as and when needed to facilitate withdrawal applications.

C. CONCLUSION

The task team has determined that the Project will satisfy the Bank's financial management requirements as stipulated by OP/BP 10.02. In terms of disbursement procedures, the Project is being deemed Ineligible for Project Management Report-Based Disbursements and will be utilizing traditional disbursement techniques, in accordance with the agreement reached between the Bank and MOF.

Annex 7: Financial Summary

China: Renewable Energy Development Project

A. WINDFARM COMPONENT

Financial Viability

The financial viability of the proposed component is estimated based on prices established under the "new plant, new price" policy, which ensures cost recovery and a return on the investments agreed between each windfarm company and the Pricing Department of each Provincial/Municipal Government. The required tariff increase would be proposed by each windfarm company and confirmed by each Provincial/ Municipal Pricing Bureau on an annual basis taking into account the following: full debt service requirements; O&M cost (including depreciation not used for debt repayments); taxes related to the proposed project; and a reasonable profit (measured by rate of return on funds invested.)

In the financial simulation, an iterative process was followed to make sure that financial covenants were met. The prices were first determined for each windfarm based on the "new plant, new price" policy. Using the calculated prices, financial simulations were carried out. If the two agreed-upon financial covenants (see section on financial covenants below) were not met in the first simulation, the price was gradually increased until full compliance was reached. Detailed assumptions used in the analysis are given below.

Using the agreed-upon pricing formula and the applying financial covenants described below, the estimated average tariffs for the windfarms would be as follows:

Average tariff prior to retirement of domestic debts (from 1999 to 2006):

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
Fen/kWh (current)	42.2	45.5	70.5	90.0
Fen/kWh (1998 Yuan)	34.6	37.4	56.5	72.2

Average tariff during the remainder of the project (from 2007 to 2020):

	Huitengxile	Zhangbei	Pingtan	Chongming/ Nanhui
Fen/kWh (current)	49.2	52.8	80.5	106.0
Fen/kWh (1998 Yuan)	23.9	25.7	38.8	51.0

The FIRR for each proposed windfarm investment is estimated as follows: Huitengxile 14.1 percent; Zhangbei: 14.1 percent; Pingtan 15.5 percent; and Chongming/Nanhui 16.2 percent.

Sensitivity analyses would not be meaningful since prices are set based on a regulated cost plus approach. As a result, the rates of return are not sensitive to either the changes in costs or the fluctuations in electricity sales.

Fiscal Impact: The proposed windfarm investment subcomponent is expected to generate the following tax revenues through 2020 (NPVs calculated at 12 percent discount rate):

(current million Yuan)	Huitengxile	Zhangbei	Pingtan	Chongming/Nanhui	Total
VAT	507.9	253.0	135.6	158.2	1,054.6
Income Tax	407.2	202.0	118.9	142.6	870.7
Sales Tax	40.6	20.2	10.9	12.7	84.4
Total	955.7	475.2	265.4	313.4	2,009.7
NPV (1998 million Yuan)					
VAT	154.1	76.8	39.4	45.5	315.8
Sales Tax	114.2	56.7	32.4	38.2	241.5
Income Tax	12.3	6.1	3.2	3.6	25.2
Total	280.6	139.6	75.0	87.3	582.5

Financing Plan

The total financing requirements for the Windfarm Investment Component (including interest during construction—IDC—of $3.7 million equivalent and the 1 percent loan service fee) are estimated at $202.7 million equivalent. The foreign exchange required is estimated at $144.4 million, of which $100 million would be financed by the proposed Bank loan.[1] The windfarm companies would contribute 20 percent of the total financing requirement for the investment component, about $40.5 million equivalent, as equity. SP would contribute $17.1 million equivalent to the equity and the provincial/municipal power companies would contribute $23.4 million equivalent. The remaining local costs and IDC for both foreign and local loans estimated at $62.1 million equivalent would be covered by loans from the China Construction Bank. A written commitment from the local bank has been issued to SP.

Financial Covenants

To promote prudent and sound financial management and adequate tariffs, the analysis was done assuming that two proposed financial covenants would be included for the project:[2]

- The windfarm companies shall not incur any debt unless a reasonable forecast of the revenue and expenditure shows that the estimated internal cash generation would provide a debt service coverage ratio of no less than 1.5 times at all times;
- The windfarm companies shall take all necessary measures, including but not limited to tariff adjustments, to earn a return of not less than 10 percent rate of return on equity (based on paid-in capital only) from the first fiscal year of operation to 2006, and on net fixed assets thereafter.[3]

Major Assumptions

The major assumptions used for Financial Projections are as follows:

General

- The general inflation rates are assumed as follows:

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1 In the financial analysis, it is assumed that the foreign exchange not covered by the World Bank loan ($44.4 million) was obtained on the same terms as the World Bank loan. Complementary analyses were carried out assuming that the $44.4 million would be financed by local loans and foreign exchange obtained on the "swap market." The results of the complementary analyses showed that prices would be slightly higher during the first seven years, and slightly lower thereafter. The complementary analyses are available in the project files.

2 The financial spreadsheets are in the project file.

3 The financial analysis described above was conducted on the basis of an assumed rate of return of no less than 10 percent on equity, defined as paid-in capital plus retained earnings, for the life of the project (covenants prior to negotiations). During negotiations, the covenant was changed, at the request of SP, to a rate of return of 10 percent on equity, defined as paid-in capital only, from the first fiscal year of operation until 2006, and on net fixed assets thereafter. Financial simulations with the revised covenants resulted in insignificant changes in the financial position of the companies. Both the original and revised spreadsheets are available in the Project Files.

Local: 0.2 (percent) for 1998, 4 for 1999, 5.0 for 2000 and thereafter.
Foreign: -2.5 for 1998, 1.3 for 1999, 2.6 for 2000, 2.7 for 2001, 2.6 for 2002, 2.5 for 2003-2005, 2.4 for 2006, 2.5 for 2007 and thereafter.

- The foreign exchange rate used is $1=Y 8.3.
- The interest rates are assumed to be 8.01 percent a year for local loans and repayable in seven years including a two-year grace period; 6 percent for IBRD loan commitment charge of 0.75 percent, loan service fee of 1 percent, and repayable in 20 years including a 5-year grace period.
- The capital investment program is based on the construction program for each of windfarm project. In the capital investment program, the base cost, physical contingencies were prepared by BERI according to the feasibility study reports provided by local electric power design institutes. The price contingency and IDC were calculated by the model.

Income Statements

- Energy sales of each windfarm company are based on the data provided in the feasibility study reports. The annual energy sales of Huitengxile Company are estimated to be 301 GWh, Zhangbei Company 139 GWh, Chongming/Nanhui Company 45 GWh and Pingtan Company 50 GWh.
- The tariffs are assumed to be adjusted so that the average revenues would be adequate to meet the requirements of debt service, to cover fixed costs and variable costs, to pay legal taxes, and to obtain reasonable profit. At the projected tariff levels for project period, debt service coverage should be no less than 1.5 and rate of return on equity should be higher than 10 percent.
- The annual depreciation rate is assumed to be 4.75 percent.
- All IDC is capitalized.
- The average wages are assumed at Y 0.018 million per year per person for the staff of Huitengxile and Zhangbei, and Y 0.024 million for Chongming Nanhui and Pingtan, and assumed to increase with the local inflation rate. Welfare is 14 percent of total wages.
- The total number of employees is calculated at 0.3 person per kW or 25 persons for Huitengxile, 15 for Zhangbei, 15 for Chongming/Nanhui, and 20 for Pingtan.
- Under the O&M costs, material cost is assumed at Y 0.001/kWh generation and escalated with local inflation rate; repair and maintenance cost is assumed at 2.0 percent of fixed assets historical cost and escalates with the local inflation rate. The Administration expenses are assumed to be at an average of Y 10,000 per person per year and escalates with the local inflation rate.
- Income tax is expected to be assessed at 33 percent of taxable income.
- Value-added tax (VAT) is 17 percent.
- Urban and education tax rates are 5 and 3 percent of VAT, respectively.
- Public Reserve and Welfare Fund is set to be 10 percent of net income after income tax and public welfare fund is 5 percent.

Balance Sheets

- Inventories are assumed 1 percent of the fixed assets.
- Accounts receivable is assumed to be reduced from 30 days' of operating revenue (including VAT).
- Account Payable are estimated at 45 days' cash operating expenses.
- Short-term loans are assumed to be 3 months of current assets excluding cash.

Funds Flow Statement

- The capital expenditures are based on the capacity construction program of each windfarm project.

Table A. Key Financial Indicators for Huitengxile Windfarm Company (1999-2009)
Yuan Million (as of December 31)

Item	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Energy Sales (100GWh)	0.75	2.25	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01
Average Price (fen/kWh)	32.04	31.28	40.70	45.00	45.00	49.67	50.01	43.55	43.27	44.06	44.93
Operating Revenue	24	70	122	135	135	149	150	131	130	132	135
Operating Income	23	56	80	79	78	91	91	71	70	71	72
Annual Capital Expenditure	386	421	0	0	0	0	0	0	0	0	0
Rate Base	100	398	682	750	692	673	635	596	558	520	481
Long-term Debt	285	646	632	618	605	566	525	496	465	433	398
Debt Service	4	25	53	52	51	75	74	60	60	60	60
Cash in Banks	7	14	29	57	87	98	110	124	134	145	157
Rate of Return(%)											
On Net Historically Valued Fixed Assets	16.8	11.4	9.8	8.8	9.4	10.9	11.4	9.7	10.1	10.9	11.8
On Net Revalued Fixed Assets	8.2	7.5	8.4	8.4	8.2	9.3	9.2	7.4	7.1	7.2	7.2
On Equity	12.0	12.0	15.2	14.8	14.6	18.5	18.1	12.5	12.3	13.0	13.5
On Equity Investment	13.1	12.9	16.8	16.7	16.9	22.9	24.0	16.8	16.8	18.1	19.6
Operating Ratio (%)	2.6	20.9	34.4	41.5	42.1	38.8	39.1	45.4	46.5	46.4	46.4
Current Ratio	6.72	5.45	6.23	9.25	12.68	13.14	14.40	17.38	18.75	19.81	20.86
Debt as % of Debt & Equity (%)	72.1	78.8	78.0	77.2	76.4	73.9	71.0	69.5	67.9	65.7	63.1
Debt Service Coverage	4.6	2.2	1.8	2.0	2.0	1.5	1.5	1.6	1.6	1.6	1.6

Table B. Key Financial Indicators for Zhangbei Windfarm Company (1999-2009)
Yuan Million (as of December 31)

Item	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Energy Sales (100GWh)	0.34	1.03	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39	1.39
Average Price (fen/kWh)	36.02	33.90	43.57	48.33	48.23	53.54	53.89	46.75	46.45	47.25	48.18
Operating Revenue	12	35	61	67	67	75	75	65	65	66	67
Operating Income	12	28	40	39	39	46	46	35	35	35	36
Annual Capital Expenditure	193	209	0	0	0	0	0	0	0	0	0
Rate Base	48	195	339	374	345	336	317	298	279	259	240
Long-term Debt	142	322	315	308	301	281	261	247	231	215	198
Debt Service	2	12	27	26	26	38	37	30	30	30	30
Cash in Banks	4	7	15	29	43	48	55	61	67	72	78
Rate of Return(%)											
On Net Historically Valued Fixed Assets	17.5	11.6	9.8	8.7	9.3	10.9	11.4	9.7	10.0	10.8	11.7
On Net Revalued Fixed Assets	8.6	7.5	8.4	8.3	8.2	9.3	9.2	7.3	7.1	7.1	7.2
On Equity	12.0	12.0	15.0	14.6	14.3	18.5	18.0	12.3	12.1	12.7	13.3
On Equity Investment	13.1	13.0	16.7	16.6	16.6	22.9	24.1	16.6	16.6	17.9	19.3
Operating Ratio (%)	2.7	20.5	34.3	41.7	42.3	38.8	39.2	45.7	46.7	46.7	46.7
Current Ratio	6.93	5.71	6.27	9.23	12.60	13.02	14.29	17.30	18.68	19.76	20.80
Debt as % of Debt & Equity(%)	71.7	78.7	77.9	77.1	76.3	73.8	70.8	69.3	67.6	65.5	62.9
Debt Service Coverage	4.8	2.2	1.8	2.0	2.0	1.5	1.5	1.6	1.6	1.6	1.6

Table C: Key Financial Indicators for Pingtan Windfarm Company (1999-2009)
Yuan Million (as of December 31)

Item	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Energy Sales (100GWh)	0.00	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Average Price (fen/kWh)	0.00	46.41	70.53	69.04	68.21	68.01	87.02	84.22	68.49	69.48	70.73
Operating Revenue	0	12	35	34	34	34	43	42	34	35	35
Operating Income	0	11	27	20	19	19	28	26	18	19	19
Annual Capital Expenditure	0	200	0	0	0	0	0	0	0	0	0
Rate Base	0	50	148	190	176	171	162	152	143	133	124
Long-term Debt	0	160	152	144	136	128	115	101	96	90	84
Debt Service	0	3	18	18	17	17	21	20	12	12	12
Cash in Banks	0	2	2	5	8	10	14	18	25	31	38
Rate of Return(%)											
On Net Historically Valued Fixed Assets	0.0	17.0	14.7	8.7	9.0	9.1	13.2	13.1	10.0	10.7	11.6
On Net Revalued Fixed Assets	0.0	8.3	10.8	8.5	8.1	8.0	10.9	10.2	7.3	7.3	7.4
On Equity	0.0	12.0	23.8	14.0	13.7	13.3	22.6	19.5	12.0	12.0	12.0
On Equity Investment	0.0	12.8	28.9	17.4	17.4	17.4	34.0	32.8	21.0	21.9	23.0
Operating Ratio (%)	0.0	5.0	22.3	42.1	43.3	44.1	35.4	37.1	46.1	46.3	46.4
Current Ratio	0.00	4.47	3.42	4.69	5.97	7.23	7.81	9.38	13.81	16.65	19.40
Debt as % of Debt & Equity(%)	0.0	78.9	75.8	74.3	72.7	71.0	65.6	60.1	57.8	55.2	52.2
Debt Service Coverage	0.0	2.5	1.5	1.5	1.5	1.5	1.5	1.5	2.1	2.1	2.1

Table D: Key Financial Indicators for Chongming and Nanhui Windfarm Company (1999-2009)
Yuan Million (as of December 31)

Item	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Energy Sales (100GWh)	0.00	0.22	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Average Price (fen/kWh)	0.00	57.77	92.08	89.26	88.18	87.94	108.31	106.83	87.63	89.13	91.05
Operating Revenue	0	13	41	40	39	39	48	48	39	40	41
Operating Income	0	12	32	23	23	22	31	30	21	21	22
Annual Capital Expenditure	0	220	0	0	0	0	0	0	0	0	0
Rate Base	0	55	162	209	193	188	178	167	157	147	136
Long-term Debt	0	176	166	157	147	138	123	108	102	96	89
Debt Service	0	4	21	20	19	19	23	23	12	12	12
Cash in Banks	0	1	2	6	9	12	16	20	28	36	44
Rate of Return(%)											
On Net Historically Valued Assets	0.0	16.9	15.5	9.1	9.5	9.5	13.2	13.4	10.3	11.1	12.1
On Net Revalued Fixed Assets	0.0	8.2	11.4	8.9	8.6	8.4	10.9	10.5	7.5	7.6	7.7
On Equity	0.0	12.0	25.5	15.0	14.4	13.9	21.4	19.1	12.0	12.0	12.0
On Equity Investment	0.0	12.6	31.4	19.3	19.3	19.3	33.9	34.1	22.3	23.4	24.7
Operating Ratio (%)	0.0	7.0	22.4	41.5	42.7	43.6	36.3	37.4	46.2	46.3	46.3
Current Ratio	0.00	3.61	3.29	4.69	6.08	7.32	7.83	9.28	13.84	16.87	19.83
Debt as % of Debt & Equity(%)	0.0	79.1	75.5	73.5	71.4	69.3	63.8	57.9	55.5	52.7	49.7
Debt Service Coverage	0.0	2.5	1.5	1.5	1.5	1.5	1.5	1.5	2.2	2.2	2.2

B. FINANCIAL SUMMARY FOR PV COMPONENT

Introduction

The following section presents a summary of a more detailed report on financial analysis of the PV component (see detailed financial analysis of the PV component, in the Project files).

Existing Companies

An estimated 25 companies assemble and sell PV systems in the six northwestern provinces covered by the Project. All are relatively new and small, with their PV business having 10 to 50 employees and few fixed assets. Seventeen of the companies (8 state-owned, 7 privately owned, 2 with mixed ownership) were visited and assisted to prepare business plans during the preparation of the Project. These 17 companies are the main market participants. The others are small proprietorship type shops and large companies, who sell an insignificant number of PV systems.

The origins of most of the companies are in the PV research and development units of state-owned renewable energy research institutes. In some cases the institutes have partially spun-off shareholding or limited-liability companies in which the state-owned entity continues to hold shares. The parent institute often continues to provide support in the form of physical facilities, research and testing, administration and distribution facilities. In other cases, former employees and sales agents of the institutes have established owner-operated, entrepreneurial private enterprises based on PV systems assembling and sales, with no continuing link with the institute, indeed entering into competition with them. In anticipation of the Project and continued growth in the market, many have recently reorganized their PV systems businesses as separate subsidiaries or as new legal entities.

Recent System Sales Growth

PV systems sales growth in these areas in recent years has been dramatic as consumer incomes have risen and demand for the modern form of energy has increased. Sales rose from an estimated 17,600 units and 423,000 Wp in 1995 to 44,600 units and 917,000 Wp in 1997 (see Chart 1 and Chart 2).[4] Total sales revenue in 1997 is reported to be Y 67 million. The average weighted size of units fell from 24 Wp in 1995 to 20 Wp in 1997, as private companies, in particular, entered the consumer market focusing on the smaller, more affordable system sizes. In 1997, systems of less than 10 Wp accounted for 16 percent of unit sales, systems in the 10-20 Wp range accounted for 74 percent, and larger systems and PV wind hybrid systems accounted for 10 percent.

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[4] The historical sales data are based on the reports from the PV companies. The estimate for 1998 is their forecast based on mid-year sales. It is estimated that the sales of the 17 companies represent some 90 percent of the market. The company sales reports are considered high for several reasons: (a) the size of the units may be overstated, most notably for the "20 Wp" models, which are generally 18 Wp; (b) there is some double-counting due to intercompany sales; and (c) there is likely a project effect, with companies slightly overstating their Wp sales so as to appear substantial candidates for selection for participation in the project.

Chart 1: PV System Sales, by Province, 1995-98

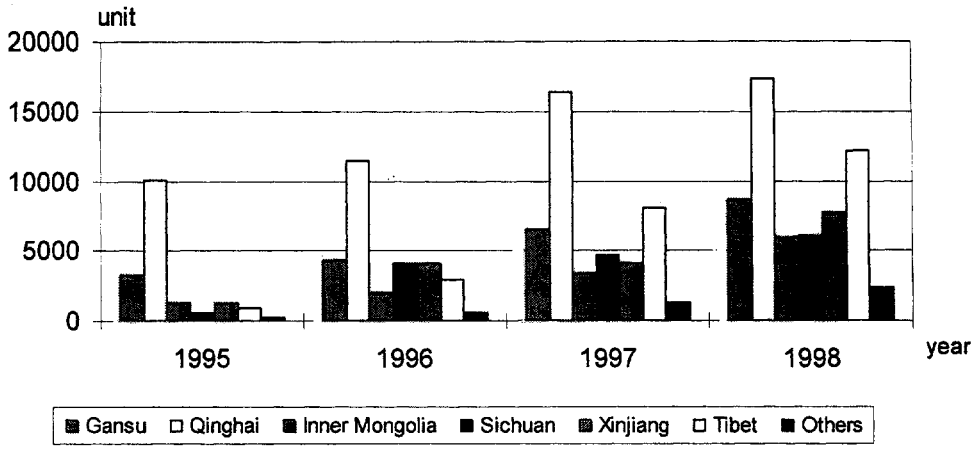


Chart 2: Total PV System Wp Sales By Province, 1995-98

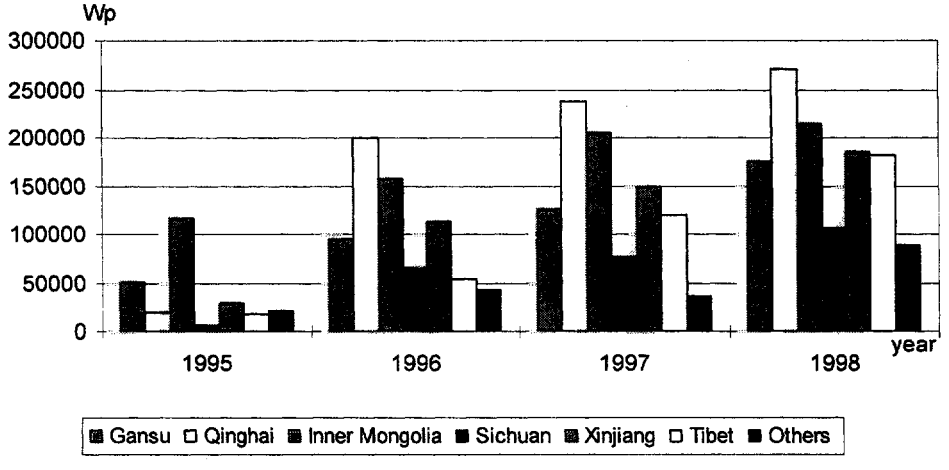


Table E: Basic Information on PV Companies

Name	Private State, mixed	Type	Year regis-tered*	Employees**	Makes Controllers Lamps Inverters
Inner Mongolia					
Inner Mongolia Huade New Technology Company	S	Limited Co.	1993	30	C,I
Inner Mongolia Huanyu Wind and Solar Energy	S	Shareholder	1998	46	C
Gansu					
Gansu Zhongxing Electronics Manufacture	S	Shareholder	1992	15	C,L,I
Gansu Genaiyong Solar Energy Power Company	S/P	Limited Co.	1996	36	C,L,I
Gansu Lanxing Wireless Equipment Company	S	Limited Co.	1988	69(20)	C,L,I
Gansu Solar PV Company	P	Shareholder	1994	42	C,L,I

Name	Private State, mixed	Type	Year regis-tered*	Employees**	Makes Controllers Lamps Inverters
Qinghai					
Qinghai Solar Energy Power Company	P/S	Shareholder	1995	34	C,L,I
Qinghai Tianpu Solar Technical Co. Ltd.(Qinghai Xining West Solar PV Company)	P	Shareholder	1997/98	28	C,L,I
Qinghai Xining New Energy Development Company	P	Shareholder	1996	45	C,L,I
Qinghai Xining Dawa Solar Energy Company	P	Shareholder	1997	19	C,L,I
Qinghai Xining Solar Energy Development Center	P	Shareholder	1995	42	C,L,I
Qinghai Xining Gesun Solar Energy Company	P	Limited Co.	1996	21	C,L,I
Xinjiang					
Xinjiang Solar Energy Development Company	S	Limited Co.	1993	52(11)	C,L,I
Xinjiang Wind Energy Company	S	Limited Co.	1987	10	C,L,I
Xinjiang Lida New Energy Electronic Co. Ltd. (Xinjiang Urumqi Lida Satellite TV Receiver Equipment Company)	P	Limited Co.	1994/98	20?	C,L,I
Xinjiang Urumqi Solar Energy Engineering Company	S	Limited Co.	1987	10	L,I
Beijing					
Beijing Jika Energy New Technology Company	S	Limited Co.	1988	12	C,I

* Cases in which company has reregistered in 1998 under a different name

** Numbers in the parenthesis are employees of the company's PV section

The most impressive growth in sales has been registered by the PV system companies headquartered in Qinghai. Sales by Xining companies increased from just under 176 kWp in 1995 to 398 kWp in 1997. The number of Xining companies selling PV systems increased from two in 1995 to eight today, with additional outlets of companies from other regions also operating there. They sell mainly 10-20 Wp systems, to customers in Qinghai, Gansu, Sichuan and Tibet. Companies based in Inner Mongolia are the second most important market group. The main market has been in Qinghai, with Inner Mongolia being the second largest market in terms of Wp.

Market Conditions

The PV systems market in the six provinces is relatively new but competitive. In 1997, four companies had 51 percent of the market in unit sales; four companies had 31 percent of the market in Wp sales; and, four companies had 36 percent of the market in sales revenue. The company with largest market share in units and which ranked second in Wp and sales revenue, is a partially state-owned one based in Qinghai. It had 1997 sales of 7,500 units, mostly 18 Wp systems in Qinghai, Tibet, Sichuan and Gansu, up from 3,500 units in 1995. However, with the growth in the total market, the entry of new companies, and the phasing out of a subsidy which was available only to this company, its market share in units has fallen from 20 percent in 1995 to 16 percent in 1997.

Companies based in Qinghai have the largest market share. The top four ranked companies in 1997 PV systems sales revenue are all based in Xining. All were registered within the last three years. Companies based in Xining accounted for 67 percent (30,000) of the total systems sold by number and 44 percent of the total Wp sold in 1997.

Privately owned companies have been gaining substantial market share. Companies that are privately owned had a 45 percent market share in 1995 in unit sales, 30 percent in Wp sales, compared with an estimated 60 percent market share in 1997 in unit sales and 41 percent in Wp sales.

Table F: Market Segmentation: Sales, by Company (1997)

	Unit			Wp			Sales revenue		
Co.	No.	%	Rank	Amount	%	Rank	Y'000	%	Rank
G	7,471	16.8	1	101,724	11.1	2	7,656	11.4	2
I	5,603	12.6	2	59,301	6.5	8	6,020	8.9	3
L	5,127	11.5	3	60,052	6.6	7	5,088	7.6	5
K	4,685	10.5	4	65,406	7.1	4	5,565	8.3	4
F	4,272	9.6	5	57,698	6.3	9	4,500	6.7	7
H	3,845	8.6	6	64,670	7.1	5	4,300	6.4	8
C	2,876	6.4	7	61,512	6.7	6	4,628	6.9	6
J	3,135	7.0	8	47,166	5.1	10	3,000	4.5	11
B	1,655	3.7	9	171,485	18.7	1	10,700	15.9	1
P	1,600	3.6	10	28,800	3.1	13	2,527	3.8	13
E	1,050	2.4	11	31,015	3.4	12	2,657	3.9	12
D	833	1.9	12	13,585	1.5	15	1,000	1.5	15
A	757	1.7	13	46,660	5.1	11	3,360	5.0	10
M	504	1.1	14	10,200	1.1	16	714	1.1	16
O	466	1.0	15	21,622	2.4	14	1,370	2.0	14
N	308	0.7	16	5,544	0.6	17	656	1.0	17
Q	413	0.9	17	70,200	7.7	3	3,617	5.4	9
Total	44,600	100.0		916,640	100.0		67,358	100.0	

Unit retail prices over 1995-98 have tended to be flat in nominal terms, or have dropped slightly. In the most competitive market, Xining, the retail prices of the popular 20 Wp system have declined in real terms in recent years, remaining at Y 1,400 since 1995, in spite of domestic inflation ranging from 21 percent in 1995 to 6 percent in 1997 and the removal of a Y 300 per unit subsidy that had been paid to one company.

There are few barriers to market entry and exit. Startup capital requirements are small, with little investment required in equipment, buildings or vehicles. The technology knowledge required is relatively simple.

There is no brand with wide recognition or significant market strength. The companies compete in terms of the quality of their product presentation and claims of customer convenience and performance. All the companies assemble and sell PV system units of varying sizes. The units of the different companies are similar in appearance, operation and performance, mainly boxed, portable PV systems units, comprising a PV module, battery, charge controller, several lights, and a wire and jack for connecting a television or radio.

The companies based in Qinghai, and some of those based in Gansu, market their products in four or more provinces through distribution networks composed of a mix of direct retail and wholesale outlets, wholly and partly owned subsidiaries, exclusive and nonexclusive consignment agents (who pay the PV companies after selling the systems), and sales brokers (who normally pay in full upon taking the goods from the company, and who then sell the goods through their own networks). Companies based in Xinjiang and Inner Mongolia tend to sell only within their provinces.

Profitability

The existing competition in the consumer market and the threat of competition from possible new entrants keep gross profit margins down, particularly for the small systems. The materials costs average 87 percent of net sales revenue from units of 20 Wp and less, and 53 percent of the revenue from 50 Wp units. Profitability is most affected by the cost of the PV modules, inventory and receivables turnover and the level of fixed operating expenses. Overall net returns have been modest. The historical net returns on

sales are estimated to range from 2 to 8 percent, and net returns on equity are estimated to range from 2 to 20 percent.

The main cost item is the panel. The panel increases in relative importance as a cost as the unit sizes increase. As a proportion of total materials costs, the panel is 51 percent for a 4 Wp system, 65 percent for a 20 Wp system and 71 percent for a 50 Wp system. Efficient procurement of panels is the most important factor in controlling materials costs.

In recent years the entry of private companies into the consumer market reduced the average Wp size of systems sold as the private companies focused heavily on the affordable, small size systems. However, it is projected that the average size of unit sold will increase during the project, as household incomes continue to rise and price increases continue to be modest in nominal terms, and either remain constant or fall in real terms. This is not expected to lead to a broad increase in profitability, as competition will remain strong.

For some companies, based on their business plans, increasing profitability will depend mainly on increasing market share. For others, increasing profitability will depend more on increasing sales of the larger sizes and shifting the sales mix to concentrate on higher value added systems.

Increasing turnover while increasing overall returns will require improvements in cost and sales recording and reporting, purchasing and inventory management, financial management, distribution systems and networks and customer incentives.

Strengths and Weaknesses of PV Companies

Technology. Technology is a consistent strength of most of the PV companies, not surprisingly given their origins in PV research and development. All continue to experiment with product improvements, particularly for controllers and lamps. At least two of the companies are led by specialists who are experts in the PV field, and several company leaders hold patents.

All of the companies make some of the balance of system and packaging components. The technology origins of the companies lead them in this direction. However, sometimes the production side receives more emphasis that the consumer sales side of the business. Given the small size of most companies, it may be more efficient for specialization to develop, with companies not seeking to combine component production and consumer sales.

System quality and consumer protection are emerging issues. The PV systems market is open with no formal technical standards to which sellers must adhere. While the companies know the technology, cost considerations and competitive pressures have led to problems such as elimination of controllers, and use of poor quality modules.

Distribution and Marketing. None of the companies has a well-developed distribution network. The mixed distribution arrangements now in place, which rely heavily on sales brokers, consignment agencies and government offices, are not suitable for a household durable which requires consumer training about proper use and maintenance and after sales service and repairs. The potential exit of PV companies from the PV systems market, through business failure or change of products or ownership, presents an uncertain prospect for customers. It is not clear how the present ten year replacement warranties on the panels which have been sold would be handled in the absence of the PV Company which made the final sale.

Most companies do not have a clear marketing strategy for positioning their products in the consumer market. For the state companies that have relied on sales to government projects, this will present a major challenge, as they shift to sales to the consumer market.

Finance. Retail sales are on a cash basis. The PV companies do not offer credit to retail customers. While the policy of cash only sales has been simple and low risk, in order to deepen the market to reach households with lower incomes some form of consumer credit or similar mechanism (fee for service leasing, rentals) is necessary. In the absence such mechanisms to increase affordability, the potential for PV systems market growth may be limited by the capability to expand into new areas, the gradual growth of consumer incomes, and the capability to lower prices through lower costs and lower margins. As companies seek to increase market share, and as some seek to increase sales of their larger size units, it is expected that some will introduce consumer credit. Inexperience with consumer credit management will pose risks for these companies.

Supplier credit has been limited. There is some trade credit, with panel and battery suppliers generally offering 30-day terms. Short-term working capital to accommodate the steep increase in sales during the high season, which in most areas is September to March, has been the main financial requirement of the PV companies. Many of the PV companies operate part of their distribution network on a consignment basis, under which independent agents pay the PV company only after receiving payments from customers.

The sales growth of those with state ownership generally has been supported by limited amounts of short- and medium-term credits from local banks. For the private companies, growth has been financed mainly by equity investments, retained earnings and loans from family, friends and others. For the companies with state ownership, subsidy programs for PV systems sales have been an important revenue source. Overall, however, sales growth has been constrained by a generalized constraint on access to commercial credit. Subsidy programs are being phased out.

Most of the companies have a relatively weak equity base. For the state companies this is not an issue at present, although with the expectation of an increasing hard budget constraint being imposed on them due to restructuring the weak equity base could hinder their continued access to credit.

Most companies will come under more formal tax administration as they expand their operations under the project. With their present small size and simple accounting systems, most are not subject to VAT and their annual tax on income is a negotiated amount or preferential rate. Under the project, they will operate more formally, and they will have added accounting and record keeping costs and possibly added tax liabilities as they become subject to the VAT and profit taxes. The expectation is that the state-owned companies gradually will begin to operate as fully commercial ventures, and that the private ones will begin to operate as formal companies, rather than as the more informal style which most now follow.

For all the companies, their present accounting systems and financial management are inadequate to manage their projected expansions in sales and provide the information needed for project monitoring. Support will be provided under the Project to assist the companies to strengthen these capabilities.

Projected Financial Performance of PV Companies Under the Project

Base Case. The base case is the projected consolidated financial performance of the PV companies under the Project. Annual sales growth is projected to be 20 percent in unit sales. Due to the gradual increase in the average size of unit sold, this results in annual sales revenue growth of more than 30 percent. This rate is less than the growth rate projected by the 17 companies assisted during project preparation, but is consistent with their financing capabilities.

Important assumptions for the base case include:

- Component and operating costs and retail prices are based on the analysis of the current operations and business plans of the 17 companies.
- Exchange rate movements and domestic inflation assumptions are those used by the World Bank for China projects at this time. The beginning exchange rate is Y 8.3/$1.
- The PV companies receive supplier trade credit, but are otherwise self-financing, depending on equity, operating income and GEF contributions.
- The GEF contribution is $1.5/Wp for units 10 Wp and larger. The projected sales include 4 Wp and 8 Wp units, but these do not receive GEF grants.
- Companies pay the normal VAT (17 percent), income taxes (33 percent) and other levies.

With these assumptions, key financial indicators are presented in Table G. The business is profitable. While net returns to sales are –1.3 percent and 1.2 percent for the first two years before taking into account the GEF grant, with the GEF contributions the returns on sales are above 15 percent, and returns to equity are more than 50 percent after the first year. To qualify for the GEF grant the companies will face higher risks, for instance, failure to supply certified equipment or to honor warranty agreements would result in the loss of eligibility to receive the GEF grants, and higher costs in procurement and after sales service.

Sensitivity. The sensitivity of profitability in the projected financial performance to changes in key assumptions was analyzed (see Table H). Two alternative scenarios were considered. The first alternative scenario considered that there would be a sudden shock in the market during the initial two years, after which markets would stabilize. The assumption in this case is that rather than the Bank's current standard projections for very modest depreciation and domestic inflation, there were a depreciation of 25 percent and inflation of 30 percent in 1999, and of 20 percent and 25 percent, respectively, in 2000. Sales are projected to fall by 15 percent in 1999 and by 10 percent in 2000, due to reduced affordability. The businesses make some adjustments, mainly by reducing their fixed administrative costs. From 2001, the assumptions would revert to the base case.

The second alternative scenario assumes the same economic conditions regarding depreciation and inflation as the base case, but assumes that the market projections are not realized. In this case, the businesses make the investments, and incur the added costs including in administrative infrastructure, but there is no sales growth in 1999 or 2000. From 2001, the assumptions would revert to the base case.

Under both scenarios, the business remained profitable with the GEF contribution. The implicit assumption in the sensitivity analyses is that companies are able to adapt to changing market conditions. However, it can also be assumed that not all companies will survive, and that the pressure of more difficult economic conditions will lead to the exit of the less competitive PV companies.

Financial Performance Indicators

The performance of the companies will be measured by the following indicators. Solvency ratios would also become important if they companies expand sales with credit financing.

	Indicator	Comment	Minimum Target
1.	Sales in units, Wp, and revenue, vs. forecast sales	Track sales growth, monitor management planning	20%,
2.	Net income without GEF / net sales	Profitability, management efficiency	2%
	Net income with GEF / net sales		15%
3.	Net income without GEF / equity	Profitability, return to owners	7%
	Net income with GEF / equity		25%
4.	Current ratio	Liquidity; current assets / current liabilities	2

Table G: Base Case: Summary Projected Statements and Key Ratios /a
Units: 1,000 Yuan

	1998	1999	2000	2001	2002	2003	2004
Operational Indicators							
Number of Units	41,700	47,955	56,587	66,773	80,127	88,140	88,140
Average Wp Size (W)	21	23	25	27	30	30	30
Total Wp (kW)	878	1090	1,429	1,836	2,391	2,631	2,631
of which: For GEF Grants (kW)		532	1,401	1,804	2,363	2,599	1,299
Income Statement:							
Net Sales Revenue	73,623	93,909	126,663	166,058	228,061	266,088	282,189
Cost of Goods sold	59,176	74,480	99,003	129,859	172,931	198,817	205,004
of which: Panel Cost	36,111	45,977	62,379	83,203	112,206	128,878	131,699
Net Income	174	-1,770	901	2,838	9,800	13,043	18,418
GEF Subsidies	0	6,734	18,099	23,842	31,930	35,902	17,951
Fund Flow Statement							
Source of Funds:							
Internal cash (Net Income + Depreciation)	0	-1,404	1,293	3,257	10,432	13,891	19,495
Loan Borrowing	0	7,000	0	0	0	0	0
Equity Infusion	0	1,500	750	750	750	0	0
GEF Subsidies	0	4,525	14,288	21,800	29,369	34,923	30,169
Total Source of Funds		11,621	16,331	25,807	40,551	48,814	49,664
Application of Funds:							
Fixed Assets Investment	0	1,530	1,591	1,655	13,123	13,302	14,109
Working Capital	0	7,485	12,473	10,054	14,337	8,643	210
Loan Repayment	0	0	0	7,000	0	0	0
Dividend Payment (from Net Income and GEF)		0	901	5,018	12,737	16,535	21,290
Total application of funds	0	9,015	14,966	23,727	40,196	38,480	35,609
Net Cash Changes	0	2,606	1,366	2,080	355	10,334	14,055
Accumulated Cash		2,606	3,972	6,052	6,407	16,741	30,796
Balance Sheet							
Current Assets	24,000	36,725	53,420	69,014	88,224	109,879	123,526
of which: Inventory	13,500	17,100	20,065	26,306	35,042	40,158	41,842
Receivable	5,250	11,285	21,803	26,769	33,651	37,809	35,079
Net Fixed Assets	4,650	5,814	7,013	8,249	20,740	33,194	46,226
Other Assets	0	0	0	0	0	0	0
Total Assets	28,650	42,539	60,434	77,264	108,964	143,073	169,751
Current liabilities	12,750	22,195	24,606	20,607	24,803	27,450	28,278
of which: Short-term Loan	7,500	14,500	14,500	7,500	7,500	7,500	7,500
Long term liabilities	0	0	0	0	0	0	0
Equity and Retained Earnings	15,900	20,344	35,827	56,657	84,161	115,623	141,473
Total Liabilities and Equity	28,650	42,539	60,434	77,264	108,964	143,073	169,751
Financial Indicators:							
Cost of Goods Sold/Net Sales	80.4%	79.3%	78.2%	78.2%	75.8%	74.7%	72.6%
Cost of Goods Sold/Net Sales with GEF Grants	80.4%	74.0%	68.4%	68.4%	66.5%	65.8%	68.3%
Net Income/Equity	1.1%	-8.7%	2.5%	5.0%	11.6%	11.3%	13.0%
Net Income with GEF Grants/Equity	1.1%	24.4%	53.0%	47.1%	49.6%	42.3%	25.7%
Net Income/Assets	0.6%	-4.2%	1.5%	3.7%	9.0%	9.1%	10.8%
Net Income with GEF Grants/Assets	0.6%	11.7%	31.4%	34.5%	38.3%	34.2%	21.4%
Net Income/Net Sales	0.2%	-1.9%	0.7%	1.7%	4.3%	4.9%	6.5%
Net Income with GEF Grants/Net Sales	0.2%	5.3%	15.0%	16.1%	18.3%	18.4%	12.9%
Net Sales/Assets	257.0%	220.8%	209.6%	214.9%	209.3%	186.0%	166.2%
Net Sales with GEF Grants/Assets	257.0%	236.6%	239.5%	245.8%	238.6%	211.1%	176.8%

	1998	1999	2000	2001	2002	2003	2004
Liabilities/Assets	44.5%	52.2%	40.7%	26.7%	22.8%	19.2%	16.7%
Operating Cost/Gross Revenue (net VAT, with GEF Grants)	98.8%	93.0%	85.0%	84.1%	81.1%	80.6%	83.7%
Breakeven Point in Sales	73,257	72,670	72,434	92,495	119,719	141,093	174,915
Breakeven Point in Units	41,167	36,817	32,107	36,906	41,733	46,364	54,185
Current Ratio	1.88	1.65	2.17	3.35	3.56	4.00	4.37
Debt Service Coverage Ratio	0.00	0.00	2.29	7.27	21.07	27.73	38.51

/a Sales estimates have not been adjusted to reflect six month delay in projected project startup, from July to Dec. 1998. This delay would have a negative impact on the company financial indicators in the first year, as their peak annual sales period is in the fall.

Table H: Sensitivity of Key Ratios to Changes in Assumed Exchange Rate, Domestic Inflation and Sales Growth

	1999	2000	2001	2002	2003	2004	
Scenario One, base case							
Total Units–1999 and 2004 are half years	22,035	52,626	62,232	76,121	83,733	41,866	338,613
Total kWp	532	1,401	1,804	2,363	2,599	1,299	9,998
Net Income/Equity	-8.70%	2.52%	5.01%	11.64%	11.28%	13.02%	
Net Income/Assets	-4.16%	1.49%	3.67%	8.99%	9.12%	10.85%	
Net Income/Net Sales	-1.89%	0.71%	1.71%	4.30%	4.90%	6.53%	
Scenario Two, economic shock—depreciation 25% and 20% in 1999 and 2000; domestic inflation 30% and 25% in 1999 and 2000; unit sales declines of 15% and 10% in 1999 and 2000; in 2001 situation reverts to base case							
Total Units	16,287	29,667	35,083	42,913	47,204	23,602	194,756
Total kWp	393	790	1,017	1,332	1,465	733	5,730
Net Income/Equity	-5.22%	-9.72%	1.44%	9.68%	9.74%	10.22%	
Net Income/Assets	-2.58%	-5.26%	0.99%	7.09%	7.53%	8.20%	
Net Income/Net Sales	-1.35%	-2.75%	0.44%	3.19%	3.75%	4.54%	
Scenario Three, zero sales growth during first two years of project							
Total Units	19,161	38,781	45,860	56,095	61,704	30,852	252,453
Total kWp	463	1,033	1,329	1,741	1,915	958	7,438
Net Income/Equity	-18.55%	-11.96%	-4.31%	5.07%	5.61%	8.16%	
Net Income/Assets	-8.53%	-6.84%	-3.24%	3.98%	4.58%	6.86%	
Net Income/Net Sales	-4.12%	-3.59%	-1.53%	1.93%	2.49%	4.17%	

Annex 8: Procurement and Disbursement Arrangements

China: Renewable Energy Development Project

A. PROCUREMENT

All goods and consultant services to be financed under the Bank loan and GEF grant would be procured in accordance with the Bank Guidelines ("Guidelines—Procurement under IBRD Loans and IDA Credits," January 1995, revised in January and August 1996, September 1997 and January 1999, and "Guidelines—Selection and Employment of Consultants by World Bank Borrowers," January 1997, revised in September 1997 and January 1999).

Windfarm Development Component

State Power would be responsible for procurement for this component. Project costs by procurement arrangements are summarized in Table A and A1. Procurement activities would be processed according to the schedule in Charts 1 and 1A.

For International Competitive Bidding (ICB), model bidding documents (May 1997) developed by MOF in collaboration with the Bank would be used. In evaluation of the bids following ICB procedures, qualified domestic manufacturers would be eligible for a margin of preference of 15 percent of the Cost, Insurance, and Freight (CIF) price or the actual custom duty, whichever is lower.

The invitation to bid for each contract estimated to cost $10 million equivalent or more shall be advertised in accordance with the procedures applicable to large contracts under paragraph 2.8 of the Bank's Procurement Guidelines. All consultant contracts exceeding $200,000 will be advertised in Development Business.

Goods. The Bank loan would be used for procurement of wind turbine/generator sets for each of the five proposed windfarms. All wind turbines would be procured under ICB. The procurement under ICB procedures would include three separate packages for wind turbines (100 MW for the Huitengxile site; 50 MW for the Zhangbei site; and 40 MW for the Fujian and Shanghai sites), ranging from approximately $29.15 million to $74.06 million.[1] Prequalification would be used to ensure "that invitations to bid are extended only to those who have adequate capabilities and resources. Prequalification may also be used to determine eligibility for preference for domestic Contractors."

A portion of the GEF grant will be used for procurement of wind monitoring equipment and required associated computers. All equipment will be procured under International Shopping (IS) procedures. The procurement is expected to include one to two contracts, with a total contract value not to exceed $150,000.

Services. Contracts amounting to about $2.85 million in total for consulting services, includingtraining, would be awarded in accordance with the Bank Guidelines. These include institutional strengthening for (a) providing training on international practice for private-sector windfarm development, developing a strategy for private sector development of windfarm projects in China, and assisting GOC in overseeing the private-sector development of one or two large windfarms sites, (b) organization restructuring and

[1] Until December 31, 2001, bid prices may be expressed in the former national currencies of the European Monetary Union. On January 1, 1999 the euro was substituted for those currencies. From that date these currencies were irrevocable fixed vis-à-vis the euro. Until December 31, 2001 these currencies remain in existence as nondecimal subdenominations of the euro.

financial management systems for the windfarm companies, (c) engineering and construction management, and (d) collection, analysis, and dissemination of performance data for windfarms in China. Selection of consultants for activities (a)-(c) would be carried out through Quality and Cost-Based Selection (QCBS). These contracts shall be based on the applicable standard for contract for consultants' services issued by the Bank, with such modifications thereto as shall have been agreed by the Bank. Other consulting services and training may be procured under Consultant's Qualification (CQ) procedures (appropriate qualification and references from an established short list) for contracts expected not to exceed $100,000 for firms, or under procedures for hiring individual consultants.

Table A: Windfarm Development Component: Costs by Procurement Arrangements (in $ million equivalent)

Expenditure Category	Procurement Method				Total Cost (including contingencies and taxes)
	ICB	NCB	Other	NBF	
1. Works					
Preparatory Works				2.84	2.84
Civil Works				10.39	10.39
Erection Works				5.90	5.90
Traffic Works				6.43	6.43
Construction Management				0.36	0.36
2. Goods					
Turbine/Generator	142.37				142.37
	(99.01)				(99.01)
Towers				17.55	17.55
Electrical, I&C, Communication Systems, Misc.				10.66	10.66
Wind Monitoring Equipment			0.15		0.15
			(0.15)		(0.15)
3. Services					
Training				0.07	0.07
Engineering Services				0.10	0.10
Technical Assistance			2.85	3.00	5.85
			(2.85)		(2.85)
4. Miscellaneous					
Land Acquisition				1.29	1.29
Total	**142.37**		**3.00**	**58.59**	**203.97**
	(99.01)		**(3.00)**		**(102.01)**

Note: NBF = Not Bank-financed (includes elements procured under parallel cofinancing procedures, consultancies under trust funds, any reserved procurement, and any other miscellaneous items).
Figures in parenthesis are the amounts to be financed by the Bank loan.
Excludes IDC and IBRD service fee.

Table A1: Windfarm Development Component: Consultant Selection Arrangements (in $ million equivalent)

Expenditure Category	Selection Method							Total Cost (including contingencies and taxes)
	QCBS	QBS	SFB	LCS	CQ	Other	NBF	
A. Firms	2.50				0.15		2.97	5.62
	(2.50)				(0.15)			(2.65)
B. Individuals					0.20		0.20	0.40
					(0.20)			(0.20)
Total	**2.50**				**0.35**		**3.17**	**6.02**
	(2.50)				**(0.35)**			**(2.85)**

Note: QCBS = Quality- and Cost-Based Selection
QBS = Quality-based Selection
SFB = Selection under a Fixed Budget
LCS = Least-Cost Selection
CQ = Selection Based on Consultants' Qualifications
Other = Selection of individual consultants (per Section V of Consultants Guidelines), Commercial Practices, etc.
NBF = Not Bank-financed.

Figures in parenthesis are the amounts to be financed by the GEF grant.

Chart 1: ICB Procurement Schedule

ID	Task Name	Duration
1	Issuance of GPN	1 day
2	Selection of Tender Co.	33 wks
3		
4	Prep. of pre-qual. docs	39 wks
5	GOC review	15 days
6	IBRD review	17 days
7	Pre-qual notices in China Daily	9 days
8	Prep. of pre-qual material	46 days
9	Eval. of pre-qual materials	15 days
10	GOC/WB review of pre-qual. eval.	32 days
11		
12	Prep of Bid Docs	30.2 wks
13	GOC/WB review of bid docs	32 days
14	Issuance of bid docs.	1 day
15	Prep. of bids	67 days
16	Eval. of bids	61 days
17	GOC review of bid evaluation	15 days
18	IBRD review of bid evaluation	17 days
19	Contract negotiation	7.2 wks
20	Contract signing	1 day

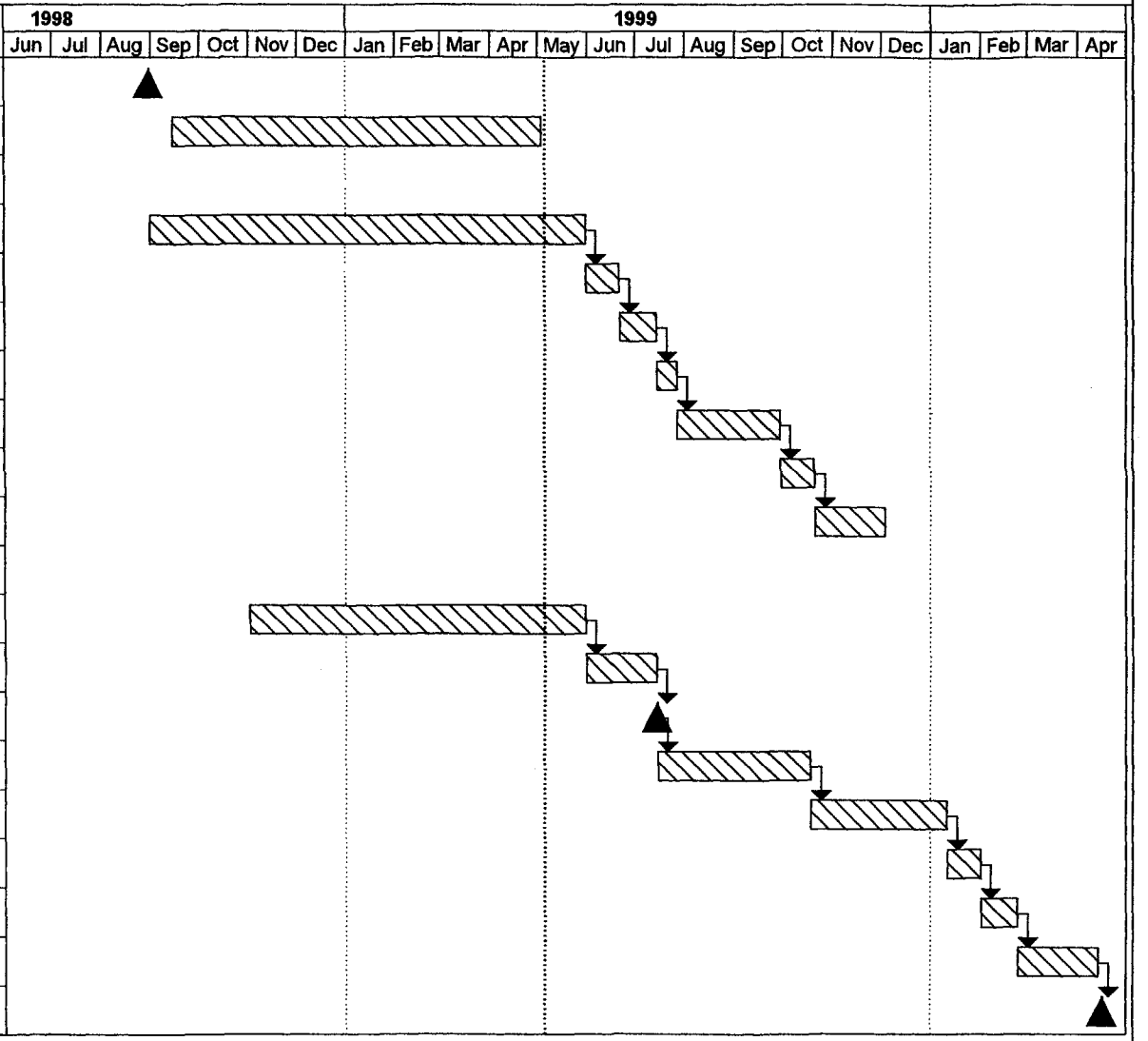


Chart 1A - Schedule for Procurement of Consultant Services

ID	Task Name	Duration
1	**Organizational Structure and Financial Mgt. Systems**	**190 days**
2	Issuance of GPN	1 day
3	Preparation of TOR and cost estimates	4 wks
4	Preparation of short list	3 wks
5	Preparation of RFP	3 wks
6	Short list and RFP to Bank for review	3 wks
7	Issuance of RFP	1 day
8	Receipt of Proposals	1 day
9	Technical evaluation	3 wks
10	Proposals and tech. eval. rpt. to WB for review	3 wks
11	Financial evaluation	3 wks
12	Final evaluation report and proposed selection to WB for review	3 wks
13	Contract Negotiations	3 wks
14	Draft contract to WB for review	3 wks
15	Contract Award	1 day
16		
17	**Engineering, Constr. Mgt., O&M Mgt.**	**190 days**
18	Issuance of GPN	1 day
19	Preparation of TOR and cost estimates	4 wks
20	Preparation of short list	3 wks

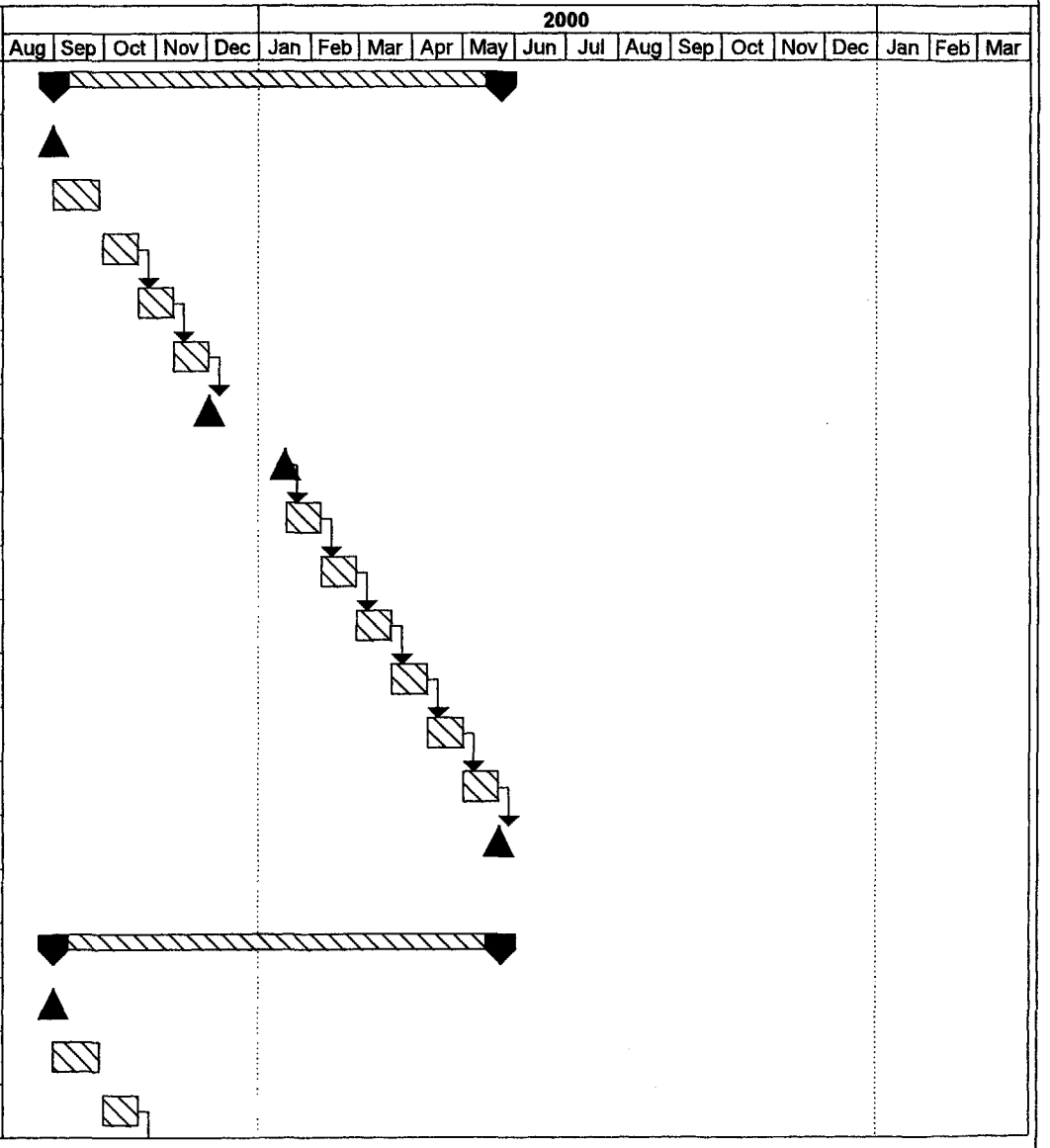


Chart 1A - Schedule for Procurement of Consultant Services

ID	Task Name	Duration
21	Preparation of RFP	3 wks
22	Short list and RFP to Bank for review	3 wks
23	Issuance of RFP	1 day
24	Receipt of Proposals	1 day
25	Technical evaluation	3 wks
26	Proposals and tech. eval. rpt. to WB for review	3 wks
27	Financial evaluation	3 wks
28	Final evaluation report and proposed selection to WB for review	3 wks
29	Contract Negotiations	3 wks
30	Draft contract to WB for review	3 wks
31	Contract Award	1 day
32		
33	**Private Sector Development**	**302 days**
34	Issuance of GPN	1 day
35	Preparation of TOR and cost estimates	6 wks
36	Preparation of short list	4 wks
37	Preparation of RFP	4 wks
38	Short list and RFP to Bank for review	3 wks
39	Issuance of RFP	1 day
40	Receipt of Proposals	1 day

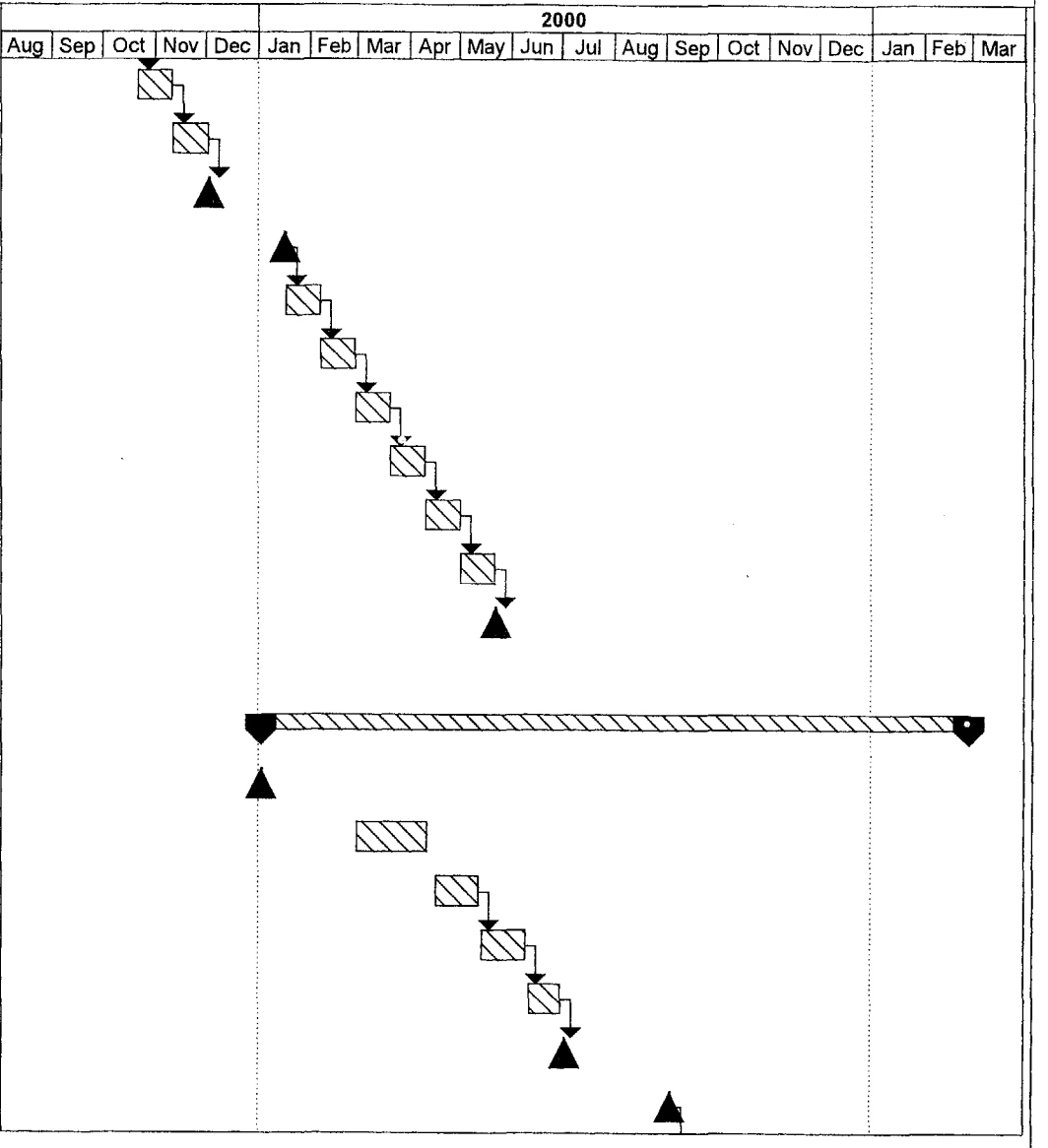
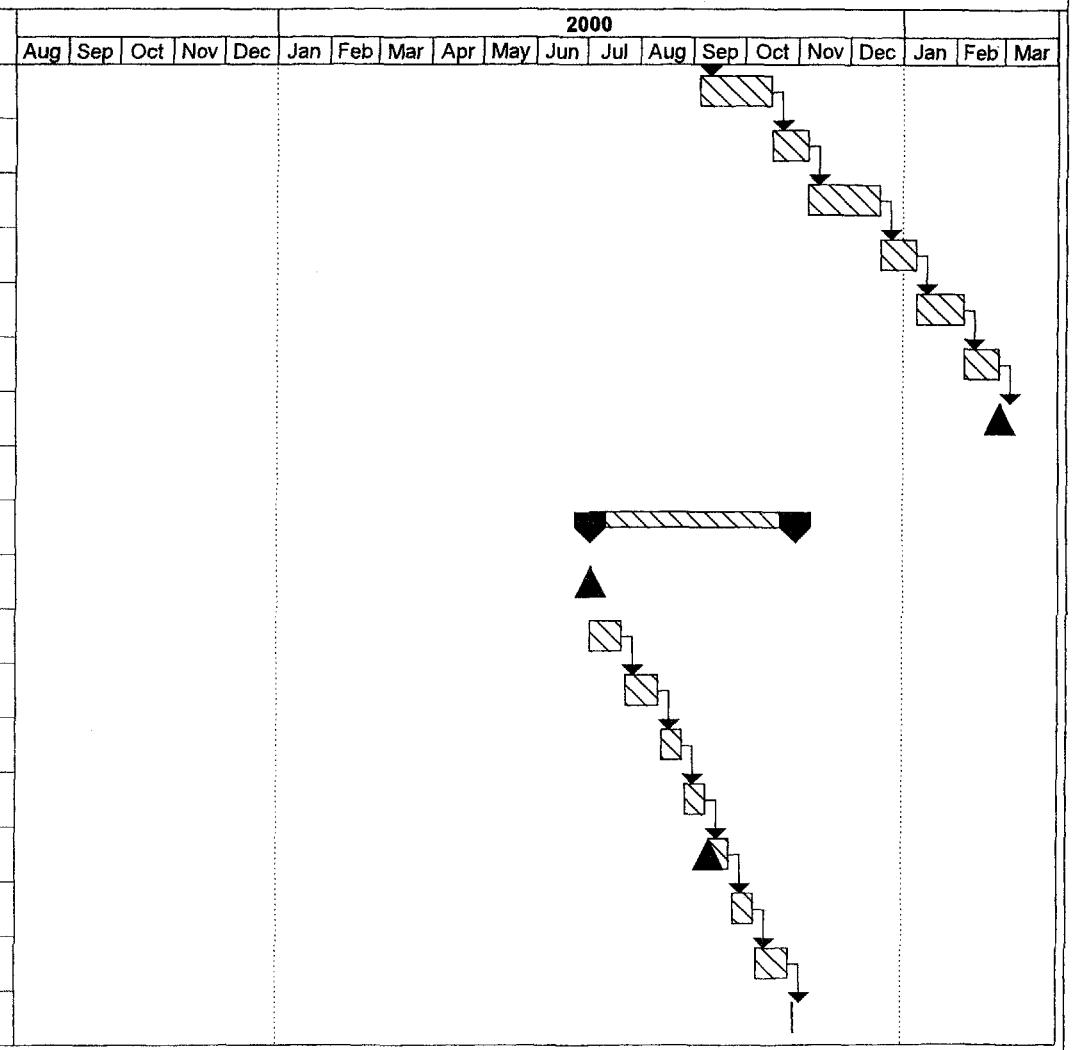


Chart 1A - Schedule for Procurement of Consultant Services

ID	Task Name	Duration
41	Technical evaluation	6 wks
42	Proposals and tech. eval. rpt. to WB for review	3 wks
43	Financial evaluation	6 wks
44	Final evaluation report and proposed selection to WB for review	3 wks
45	Contract Negotiations	4 wks
46	Draft contract to WB for review	3 wks
47	Contract Award	1 day
48		
49	**Collection, Dissemination, and Analysis of Performance Data**	**86 days**
50	Issuance of GPN	1 day
51	Preparation of TOR	3 wks
52	TOR to Bank for review	3 wks
53	Preparation of short list	2 wks
54	Selection of firm	2 wks
55	Proposal submitted	2 wks
56	Contract negotiation	2 wks
57	Draft contract to Bank for review	3 wks
58	Contract award	1 day



Prior Review Thresholds (Table B). Prior review of draft prequalification and bidding documents, bid evaluation reports and contract award recommendations and contracts would be carried out for all ICB contracts. This would cover 100 percent of the Bank loan. Prior review of the terms of reference, cost estimates, selection criteria, consultant shortlists, request for proposals, bid evaluation reports, and contract award recommendations and contracts would be required for all consultants. For all goods contracts to be awarded on the basis of international shopping, prior review shall be required for all requests for quotation, evaluation, and contracts/purchase orders.

Table B: Windfarm Development Component: Thresholds for Procurement Methods and Prior Review

Expenditure Category	Contract Value (Threshold $ thousands)	Procurement Method	Contracts Subject to Prior Review/ Estimated Total Value Subject to Prior Review ($ millions)
1. Goods	all contracts	ICB	Three contracts subject to prior review/ $142.37 million
	all contracts	IS	1 – 2 contracts for wind monitoring equipment subject to prior review; $0.15 million
2. Services	all contracts	QCBS or CQ	Five institutional strengthening contracts/ $2.85 million/ all subject to prior review
Total value of contracts subject to prior review:			$145.37 million

PV Component Procurement

Project costs by procurement arrangements are summarized in Table C and C1. A typical procurement processing schedule for selection of consultants is shown in Table D.

Goods. All PV components and systems will be procured by participating PV companies under established commercial practices. International or national competitive bidding for equipment and services—such as procurement of PV modules, batteries, light fixtures, electronic controllers, or wind turbines for hybrid systems—would not be feasible for the PV companies because the size of individual procurement would be too small, and the grouping of contracts is not practical due to dispersal in time and location. All of the contract packages would be well under $1.0 million, with the typical package in the range of $0.05-0.20 million. The typically small sizes of the individual procurement packages offer several advantages to the companies: (a) just-in-time procurement reduces inventory carrying costs; (b) smaller packages reduce the incremental borrowings and the associated need for injecting fresh equity and collateral, a critical constraint; (c) opportunities for the companies to buy components on the spot market, where good deals are commonly available; and (d) opportunities to take advantage of lower prices given that the prices of key components such as PV modules are expected to continue to decline over time.

Efficient procurement is ensured through companies soliciting various quotations to obtain reasonable terms (prices and terms of suppliers' credit, as well as availability of technical support, warranty conditions, etc.), since it is in their best commercial interest to do so.

A portion of the GEF grant provided for institutional strengthening will be used for procurement of testing equipment. All equipment will be procured under International Shopping (IS) procedures. The procurement is expected to include seven contracts, with a total value not to exceed $500,000.

Services. Contracts amounting to $6.5 million in total for consulting services, including training, would be awarded in accordance with Bank Guidelines. All consultant contracts exceeding $200,000 will be advertised in the *UN Development Business*. The PMO will be responsible for procurement of all consulting services. These include technical services for market development, strengthening the

capabilities of testing and certification centers, product performance and quality improvement and project management. Selection of consultants will be based on QCBS for contracts with firms exceeding $100,000 and Consultant Qualifications (CQ) procedures for all other contracts, including contracts with individual consultants.

Table C: PV Component: Costs by Procurement Arrangements ($ million equivalent)

Expenditure Category	Procurement Method ICB	NCB	Other	NBF	Total Cost (including Contingencies)
1. PV Systems			120.3	24.6	145.0
			(15.0)		(15.0)
2. Institutional Strengthening					
Services			6.5	4.0	10.5
			(6.5)		(6.5)
Equipment			0.5		0.5
			(0.5)		(0.5)
Total			**127.3**	**28.6**	**156.0**
			(22.0)		**(22.0)**

Note: NBF = Not Bank-financed includes taxes and duties.
Figures in parentheses are GEF grant-funded components.

Table C1: PV Component: Institutional Strengthening Subcomponent Costs by Selection Arrangements ($ million equivalent)

Category	Procurement Method QCBS	QBS	SFB	LCS	CQ	Other	NBF	Total Cost (including Contingencies)
Firms	1.0				4.0		4.0	8.0
	(1.0)				(4.0)			(5.0)
Individuals					1.5			1.5
					(1.5)			(1.5)
Total	1.0				5.5		4.0	10.5
	(1.0)				(5.5)			(6.5)

Amount in parentheses is GEF-funded
NBF = Not Bank-financed

Table D: Typical Procurement Processing Schedule (in calendar days)

Selection of Consultants – QCBS	Calendar days
Advertisement procedure	60
Development of short list and LOI package	21
Bank review and clearance	10
Request for proposals	10
Submission of proposals	45
Evaluation and award recommendation	35
Clearance of competent authorities	10
Bank no objection	15
Issue letter for negotiations	5
Negotiation and formalization of contract and draft contract to Bank	21
Draft contract – Bank no objection	10
Contract signature	5
Mobilization	30
Total	217

Prior Review Thresholds (Table E). Prior review of the terms of reference, cost estimates, selection criteria, consultant shortlists, request for proposals, bid evaluation reports, and contract award recommendations and contracts would be required for all consultants. Prior review of requests for quotations (including description of goods and desired time and place of delivery), evaluation, and contracts/ purchase orders will be required for all goods contracts in support of institutional strengthening activities exceeding $100,000.

Table E: PV Market Development Component: Thresholds for Procurement Methods and Prior Review

Expenditure Category	Contract Value (Threshold, $)	Procurement Method	Contracts Subject to Prior Review / Estimated Total Value Subject to Prior Review ($)
1. Goods			
Testing equipment for institutional strengthening TA	$100,000	IS	2 – 3 contracts/$0.3 million
2. Services			
Market Development Support and Institutional Strengthening	All contracts All contracts	QCBS or CQ	at least 25 contracts/$6.5 million (minimum)
Total value of contracts subject to prior review:			$6.8 million (minimum)

Technology Improvement Component

Project costs by procurement arrangement are summarized in Tables F and F1. The processing schedule for selection of consultants will follow a schedule similar to that shown in Table D.

Goods. The proceeds of the GEF grant will be used to support technology improvement projects developed by companies or institutions for PV and wind components and/or systems. Procurement will follow established commercial procedures (similar to other Bank-supported projects with cost-sharing arrangements; e.g., Indonesia Industrial Technology Development Project, Republic of Mauritius Technical Assistance to Enhance Competitiveness). This approach is justified due to the proprietary nature of the goods and/or services required by companies and institutions requesting financial support and because the recipient companies/institutions will be selected by the PMO on a competitive basis. Procurement packages will typically comprise: (a) labor of personnel of the companies or institutions applying for financial support, (b) local and/or international consultant services, (c) testing of materials, components, or systems by national or international institutions, (d) production of prototypes, materials, components, and systems, and (e) field testing. The average size of the procurement packages is expected to be below $0.2 million, although individual procurement packages may be larger. Efficient procurement is ensured because companies and institutions must provide 50 percent of the project cost, and because it is in their best commercial interest to obtain the lowest prices for the services they require.

A portion of the GEF grant provided for institutional strengthening will be used for procurement of goods. All goods will be procured under International Shopping (IS) procedures. The total value of contracts procured is not expected to exceed $150,000.

Services. Contracts amounting to $850,000 in total for consulting services, including training would be awarded in accordance with Bank Guidelines. All consultant contracts exceeding $200,000 will be advertised in the *UN Development Business*. The PMO will be responsible for all procurement of services. These include technical services for program management, local and international consultants for evaluating proposals, and overseeing project solicitation. Selection of consultants will be based on Consultant Qualifications (CQ) procedures for all contracts.

Table F: Technology Improvement Component: Costs by Procurement Arrangements ($ million equivalent)

Expenditure Category	Procurement Method				Total Cost (including contingencies)
	ICB	NCB	Other	NBF	
1. Investments					
Large Grant Program and Small Grant Program			9.00	9.00	18.00
			(9.00)		(9.00)
Concessional Loan Program				60.00	60.00
2. Institutional Strengthening					
Services			0.85	0.60	1.45
			(0.85)		(0.85)
Goods			0.15		0.15
			(0.15)		(0.15)
Total			**10.00**	**69.60**	**79.60**
			(10.00)		**(10.00)**

Note: NBF = Not Bank-financed includes taxes and duties.
Figures in parentheses is GEF grant-funded components.

Table F1: Technology Improvement Component: Costs by Consultant Selection Arrangements ($ million equivalent)

Consultant Services Expenditure Category	Selection Method							Total Cost (including contingencies)
	QCBS	QBS	SFB	LCS	CQ	Other	NBF	
Firms								
Individuals					0.85		0.60	1.45
					(0.85)			(0.85)
Total					**0.85**		**0.60**	**1.45**
					(0.85)			**(0.85)**

Amount in parentheses is GEF-funded
NBF = Not Bank-financed.

Prior Review Thresholds (Table G): Prior review of the terms of reference, cost estimates, selection criteria, consultant shortlists, request for proposals, bid evaluation reports, and contract award recommendations and contracts would be required for all consultant contracts. Prior review of requests for quotations (including description of goods and desired time and place of delivery), evaluation, and contracts/ purchase orders will be required for all goods contracts in support of institutional strengthening activities exceeding $100,000.

Table G: Technology Improvement Component: Thresholds for Procurement Methods and Prior Review

Expenditure Category	Contract Value (Threshold $ thousands)	Procurement Method	Contracts Subject to Prior Review/ Estimated Total Value Subject to Prior Review ($ millions)
Large Grant Program	n.a.	n.a.	
Small Grant Program	n.a.	n.a.	
Technical Assistance			
Services	All contracts	CQ	At least 30 contracts/$850,000 (minimum)
Goods	$100,000	IS	N/A
Total value of contracts subject to prior review:			$850,000 (minimum)

B. DISBURSEMENT

Windfarm Development Component

Allocation of Loan and Grant Proceeds (Table I). The Bank loan would be disbursed against (a) 100 percent of the foreign expenditures for directly imported equipment and materials quoted on a CIF basis, (b) 100 percent of local expenditures (ex-factory cost), and (c) 75 percent of local expenditures. The Grant would be disbursed against (a) 100 percent of the foreign expenditures for directly imported equipment and materials quoted on a CIF basis, (b) 100 percent of local expenditures (ex-factory cost), (c) 75 percent of local expenditures, and (d) 100 percent of the expenditure for consulting services and training.

The estimated annual disbursement schedule for the loan is shown in the Project Financing data in page 1 and detailed in the PIP (available in the project file). It reflects the Bank's experience with previous power projects in China. Loan disbursements will be made directly to the selected turbine suppliers. The loan is expected to be disbursed over a period of about three years. The project completion date would be December 31, 2004 and the loan closing date would be June 30, 2005. The estimated annual disbursements of GEF grant funds supporting the institutional strengthening aspects of the project are shown below.

Table H: Disbursement Schedule—GEF Grant for Windfarm Development Component

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Total
Annual	0.0	0.3	0.9	0.6	0.6	0.5	0.1	3.0
Cumulative	0.0	0.3	1.2	1.8	2.4	2.9	3.0	3.0

Use of Statements of Expenses (SOEs). Since all contracts require prior review, the use of SOEs is not applicable.

Special Account. In order to facilitate timely disbursements, a Special Account (SA) will be opened and maintained for the GEF grant supporting institutional strengthening activities under the Windfarm Development Component. This SA will be opened and maintained in a commercial bank on terms and conditions acceptable to the Bank. After an initial deposit by the Bank into this account, further replenishments (equivalent to the Bank's share of expenditures for an average four-month period) would take place upon the Bank receiving applications for withdrawals from MOF. Replenishment to the SA would be made on a monthly basis, or when 50 percent of the SA balance has been used, whichever comes first. The authorized allocation to be deposited into the SA shall initially be $150,000 and shall be increased to $250,000 when disbursements have exceeded approximately $746,200.

Table I: Windfarm Development Component: Allocation of Loan Proceeds

Expenditure Category	Amount in $ million	Financing Percentage
1. Windfarm Investments		
Goods	99.0	100% of the foreign expenditures or directly imported equipment and materials quoted on a CIF basis; 100% of local expenditures (ex-factory cost); 75% of local expenditures for other items procured locally
Fee	1.0	IBRD Service Fee
2. Institutional Strengthening		
Services	2.85	100% of the expenditure for consulting services and training
Goods	0.15	100% of the foreign expenditures or directly imported equipment and materials quoted on a CIF basis; 100% of local expenditures (ex-factory cost); 75% of local expenditures for other items procured locally
Total	**103.00**	

PV Component

Allocation of Grant Proceeds (Table K). The grant would be disbursed as follows (a) $1.50/Wp equivalent per PV system, with a PV module rated at 10 Wp or larger; and (b) about $3 million would be reserved to be used for support for development of financing mechanisms to enable customers to pay for PV systems over time. A study will be undertaken under the direction of the PMO to assess the options for support for such financing mechanisms to deepen the PV market. If the effectiveness of such a mechanism is demonstrated and demand for GEF cofinancing is confirmed, the PMO would prepare the operating procedures for the mechanism. The study would commence soon after grant effectiveness. The mechanism would be established within one year of grant effectiveness. During periodic reviews of the project, the effectiveness of the mechanism would be evaluated and a decision would be taken by the Bank in consultation with SETC as to determine whether the mechanism is to continue and the amount of funds to be set aside. If the demand for funds from the facility is low, the Bank in consultation with SETC can close this facility and provide the funds as a direct grant.

The allocation of the grant proceeds for institutional strengthening activities would be disbursed against (a) 100 percent of the foreign expenditures for directly imported equipment and materials quoted on a CIF basis, (b) 100 percent of local expenditures (ex-factory cost), (c) 75 percent of local expenditures, and (d) 100 percent of the expenditure for consulting services and training. The estimated annual disbursements of the GEF grant in support of the PV Component is shown below.

Table J: Disbursement Schedule – GEF Grant for Solar PV Component

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Total
Annual	0.9	3.2	4.2	5.1	5.8	2.6	0.3	22.0
Cumulative	0.9	4.0	8.3	13.4	19.1	21.7	22.0	22.0

Special Account. In order to facilitate timely disbursement, a single Special Account (SA) would be opened and maintained for the GEF grant supporting the PV and Technology Improvement Components (i.e., one SA for the two components), at a commercial Bank under terms and conditions satisfactory to the Bank. After initial deposits by the Bank into these accounts, further replenishment (equivalent to the Bank's share of expenditures for an average four month period) would take place upon the Bank receiving applications for withdrawals from MOF. Replenishment to the SA would be made on a monthly basis, or when 50 percent of the SA balance has been used, whichever comes first. The authorized allocation to be deposited into the SA shall initially be $1,200,000 and shall be increased to $2,000,000 when disbursements have exceeded approximately $8,000,000.

The grant would be disbursed only after the company has installed a PV system and provided documentation of acceptance of installation and a duly executed purchase contract with the buyer. For the initial grant to each company, disbursement would take place only after the PMO notifies the Bank that it has conducted a satisfactory audit of the company's first 25 installed units and the Bank issues a no-objection letter to MOF to release the grant to the company.

Table K: PV Component: Allocation of Grant Proceeds

Expenditure Category	Amount in $ million	Financing percentage
Goods		
PV Systems	15.0	$1.50/Wp for rated capacity of PV module in PV system with module rated at 10 Wp or larger
Testing equipment, office equipment	0.5	100% of foreign expenditures; 100% of local expenditures (ex-factory cost); 75% of local expenditures for other items procured locally
Services		
Market Development Support*	5.0	100% of expenditures for consulting services and training
Institutional Strengthening	1.5	100% of expenditures for consulting services and training
Total	**22.0**	

* Includes $3 million reserved for possible cofinancing facility.

Technology Improvement Component

Allocation of Grant Proceeds (Table M). The GEF Grant would be disbursed against (a) 50 percent of local and foreign expenditures for goods and services under the Large Grants Program and Small Grants Program. Seventy percent of the grants under the Large Grants and Small Grants Programs would be disbursed for eligible windfarm TI subprojects; 30 percent of the grants disbursed under these Programs would be for eligible PV TI subprojects. For institutional strengthening activities, the Grant would be disbursed against (a) 100 percent of the foreign expenditures for directly imported equipment and materials quoted on a CIF basis, (b) 100 percent of local expenditures (ex-factory cost), (c) 75 percent of local expenditures, and (d) 100 percent of the expenditure for consulting services and training. The estimated annual disbursements of the GEF grant in support of the Technology Improvement Component is shown below.

Table L: Disbursement Schedule—GEF Grant for Component

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Total
Annual	0.0	1.8	2.4	2.5	1.9	1.4	0.1	10.0
Cumulative	0.0	1.9	4.3	6.7	8.6	10.0	10.0	22.0

Use of Statements of Expenses (SOEs). Since all contracts require prior review, the use of SOEs is not applicable.

Special Account. As mentioned above, a single SA will be opened and maintained at a commercial bank under terms and conditions satisfactory to the Bank for the PV and Technology Improvement Components. After initial deposits by the Bank into these accounts, further replenishment(equivalent to the Bank's share of expenditures for an average four month period) would take place upon the Bank receiving applications for withdrawals from MOF. Replenishment to the SA would be made on a monthly basis, or when 50 percent of an the balance has been used, whichever comes first. As mentioned above, the authorized allocation to be deposited into the SA shall initially be $1,200,000 and shall be increased to $2,000,000 when disbursements have exceeded approximately $8,000,000.

Table M: Technology Improvement Component: Allocation of Grant Proceeds

Expenditure Category	Amount in $ million	Financing percentage
1. Large Grant Program		
Windfarm TI Subprojects	5.60	50% of local and foreign expenditures for goods and services
PV TI Subprojects	2.40	50% of local and foreign expenditures for goods and services
2. Small Grant Program		
Windfarm TI Subprojects	0.70	50% of local and foreign expenditures for goods and services
PV TI Sub-projects	0.30	50% of local and foreign expenditures for goods and services
3. Technical Assistance		
Services	0.85	100% of expenditures for consulting services and training
Goods	0.15	100% of foreign expenditures; 100% of local expenditures (ex-factory cost); 75% of local expenditures for other items procured locally
Total	**10.00**	

Annex 9: Land Acquisition and Resettlement (Windfarms)

China: Renewable Energy Development Project

General

The China Renewable Energy Development Project consists of three project components of which only the Windfarm Development Component would involve land acquisition. This project component includes the construction of five windfarms in four provinces, autonomous regions, and municipalities. Each windfarm would involve land acquisition. However, only the proposed windfarm at Zhangbei, Hebei Province would acquire land assigned to individuals; the remaining windfarm investment projects would acquire land from a state-owned husbandry operation, a state-owned farm, and a municipal flood control agency.

Minimization of the scope of land acquisition was, and will continue to be, a high priority throughout the planning, design, and implementation of the proposed project. Where land acquisition is unavoidable, the resettlement plans provide for compensation, services, and resources to improve, or at least restore, the living conditions and income of the project-affected persons (PAPs).

Resettlement action plans (RAPs) were prepared for each proposed windfarm project (Huitengxile, Zhangbei, and Pingtan RAPs: October 1998; Shanghai RAP: August 1998). Each RAP includes: (a) background information on the proposed project area, including population, major economic activities, and present income levels, (b) project impacts, (c) applicable policies and regulations, (d) compensation budgets, (e) disbursement plans, (f) institutional arrangements and implementation procedures, (g) payment schedules, and (h) grievance procedures. The Bank carried out a full review of each RAP and found that the resettlement needs of the PAPs are well analyzed and the mitigating measures of social impacts are adequate. The RAPs were cleared by the Bank in November 1998 and are available in the World Bank Public Information Center (PIC).

Scope of Resettlement and Land Acquisition

According to resettlement estimates, the five windfarm projects would (a) require permanent acquisition of 603.6 mu (about 40 hectares; primarily for turbine foundations, pad-mounted transformers, roads, substations, and buildings), (b) require temporary acquisition of 1,131.8 mu (approximately 75 hectares; for construction activities and storage of delivered equipment), and (c) affect 68 persons due to land loss.

Windfarm	Number of Relocated House-holds (persons)	Amount of Removed Floor Space (m^2)	Land Acquired Permanently (mu)	Land Acquired Temporarily (mu)	Number of People Affected by Land Loss
Huitengxile, Inner Mongolia Autonomous Region (100 MW)	0	0	340.0	601.2	0
Zhangbei, Hebei Province (50 MW)	0	0	195.3	298.8	68
Pingtan, Fujian Province (20 MW)	0	0	9.00	200.0	0
Chongming Island, Shanghai Municipality (14 MW)	0	0	41.9	20.6	0
Nanhui Island, Shanghai Municipality (6 MW)	0	0	17.4	11.2	0
Total	**0**	**0**	**603.6**	**1,131.8**	**68**

Legal Framework

The land acquisition and resettlement of the Windfarm Development Component of the China Renewable Energy Development Project are based on state laws and/or regulations as well as provincial/regional/

municipal implementation measures. The state laws and regulations include the "Land Administrative Law" (1988). The provincial/regional/municipal implementation measures include:

- for Huitengxile, Inner Mongolia Autonomous Region: "Administrative Procedures for the Implementation of the Law of the People's Republic of China on Land" (1992);
- for Zhangbei, Hebei Province: "Hebei Province Land Management Regulations";
- for Pingtan County, Fujian Province: "Implementation Regulation of Fujian Province to Land Administration Law" (1987), "Implementation Regulations of Fujian Province to Forest Law" (1992) and "Regulations for Shelter Forest Along Coast Area of Fujian Province" (1995); and
- for Shanghai Municipality: "Shanghai Beach Administration Regulations" (1997), and "Shanghai Land Use Right Transfer Methods" (1996).

The detailed compensation for lost young crops, land and property (as presented in the RAPs) would apply to all resettlement actions carried out under the proposed project.

Resettlement Institutional Arrangements

Separate resettlement institutional arrangements have been established for each windfarm facility.

Huitengxile, Inner Mongolia Autonomous Region. Five organizations would participate in the land acquisition aspects of the project.

- The Resettlement Office of the planned windfarm company would be responsible for formulating policy, coordinating activities with all other organizations, informing local residents of the policy, and reporting to internal and external agencies.
- The on-site resettlement office of the planned windfarm company would have primary responsibility for enforcing and implementing the resettlement policy.
- The Resettlement Office of the Chayouzhong Banner Land Administration Bureau would handle all administrative matters associated with the RAP.
- The Resettlement Office of the Huitingiang Stud Farm would monitor the impact of the windfarm on the stud farm as well as the recovery of temporarily affected grassland.
- The Inner Mongolia Electric Power Science and Research Institute would serve as an external supervision organization and would provide supervision assessment reports to the windfarm company and World Bank.

Zhangbei, Hebei Province. Six organizations would participate in land acquisition aspects of the project.

- The Resettlement Office of the planned windfarm company would be responsible for overall coordination, formulating policy, informing local residents of the policy, and reporting to internal and external agencies.
- The Zhangbei County Land Administration Resettlement Office would hold primary responsibility for executing the resettlement policies and carrying out the land acquisition procedures.
- The Youlougou Town Resettlement Office would coordinate the grievance process.
- The Huanghuapin Village Group and the Xishui Village Group would verify the affected lands, manage the compensation process, relay the opinions of the villagers to the County Resettlement Office, and resolve grievances.
- The North China Electric Power Science Institute would serve as the independent exterior inspection and evaluation organization and would be responsible for inspecting the entire resettlement process, reporting to the World Bank, and providing technical consultation to the windfarm company.

Pingtan County, Fujian Province. Six organizations would participate in land acquisition aspects of the project.

- The Preparatory Office of the Windfarm Development Company will be responsible for preparing all land acquisition aspects of the project.

- The Fujian Pingtan Changjiang'ao Windfarm Development Company will be responsible for implementation of the resettlement action plan.
- The County Forest Bureau is in charge of applying for all licenses and restoration of all vegetation.
- The County Land Administration Bureau is in responsible for registering all licenses.
- The Resettlement Office of the Fujian Pingtan State Shelter Forest Farm is responsible for management and utilization of the compensation fees.
- The East China Investigation and Survey Design Institute will serve as the independent, external monitor for the project.

Chongming Island and Nanhui, Shanghai Municipality. Land acquisition at both windfarms consists of land transfer between state-owned organizations. As a result, the Shanghai Municipal Electric Power Company would directly pay the Qianshao Farm (on Chongming Island) and Magnolia Resort (Nanhui) compensation for permanently and temporarily acquired lands in accordance with state and municipal laws and regulations.

Public Consultation and Grievance Process

In the process of formulating resettlement policies and developing RAPs, special attention was given to consultation with affected people and organizations. In the project feasibility phase, the PMO consulted extensively with local governments, local people's congress, nongovernment organizations, and individuals with regard to the site selection. All affected villages and individuals were consulted during the resettlement planning phase and through surveys. Numerous meetings were held with affected people and local officials on compensation policies and rehabilitation measures. Their concerns have been incorporated in the RAPs. In addition, serious efforts would be made to inform all affected people about resettlement policies and entitlements. Further consultation with affected people would be ensured by the resettlement institutions during implementation.

To ensure that the resettlement program is implemented successfully and that complaints are processed in a timely fashion, special grievance procedures have been established and would be publicized to all resettlers.

- **Huitengxile, Inner Mongolia Autonomous Region.** If the Huitingiang Stud Farm (i.e., the state-run farm from which land is being acquired) is unsatisfied, they can submit an appeal to the Resettlement Office of the Chayouzhong Banner Land Administration Bureau, which would have 15 days to respond to the appeal. If the Huitingiang Stud Farm is not satisfied with the response, they may appeal to the on-site resettlement office of the planned windfarm company, which would have 15 days to respond to the appeal. If the Huitingiang Stud Farm is not satisfied with this response, they may bring legal action against the resettlement office of the planned windfarm company within 15 days of receiving the resettlement office's response and at a local court in accordance with the clauses under the "Land Administration Law."
- **Zhangbei, Hebei Province.** If the local peasants are not satisfied, they can submit an appeal to the Huanghuapin Village Group, the Xishui Village Group and/or the Youlougou Town Resettlement Office. A response would be issued within 15 days. If the peasants are not satisfied with the response, they may appeal to the Zhangbei County Land Administration Resettlement Office, which would issue a response within 15 days. If the peasants are not satisfied with the response, they may submit an appeal to the resettlement office of the planned windfarm company, which would issue a response within 15 days. If the peasants are not satisfied with this response, they may appeal to a local court with 15 days of receiving a response from the resettlement office of the planned windfarm company.
- **Pingtan County, Fujian Province.** If the Fujian Pingtan State Shelter Farm is not satisfied with the implementation of the land acquisition process, they may appeal to the County Land Administration Bureau. The Bureau would issue a response within two weeks. If the Shelter Farm is not satisfied with the Bureau's decision, they may appeal to the Fujian Pingtan Changjiangao Windfarm

Development Company, which will issue a response within two weeks. If the Shelter Farm is not satisfied with this response, they may appeal to the Civil Division of the People's Court according to the Civil Procedure Law.

- **Shanghai.** Appeals can be made, in stages, to the authorities in the following order: Land Acquisition Business Administration of the county; House and Land Administration of Shanghai; the People's Court.

Budget and Timetable

Based on preliminary budget projections, resettlement costs would amount to Y 8.66 million. These costs include contingencies, administrative fees, monitoring and evaluation costs and the cost of technical training.

Windfarm	Compensation for Permanently Acquired Land (Yuan)	Compensation for Temporarily Acquired Land (Yuan)	Other /a (Yuan)	Contingency (Yuan)	Total (Yuan)
Huitengxile, Inner Mongolia Autonomous Region (100 MW)	3,513,850	400,800	254,452	625,365	4,794,467
Zhangbei, Hebei Province(50 MW)	985,833	207,359	280,191	147,342	1,620,725
Pingtan, Fujian Province (20 MW)	180,000	600,000	51,285	49,887	881,172
Chongming Island, Shanghai Municipality (14 MW)	606,500	174,200	66,300	50,800	897,800
Nanhui, Shanghai Municipality (6 MW)	299,400	102,300	34,100	26,100	461,900
Total	5,585,583	1,484,659	686,328	899,494	8,656,064

/a Includes crop compensation, administrative fees, monitoring and evaluation, and technical training.

Annex 10: Environmental Management Program (Windfarms)

China: Renewable Energy Development Project

A. Summary of Key Environmental Issues

Noise

Major sources of noise pollution include construction vehicles and aerodynamic interaction between the wind and turbine blades. During construction, all equipment will be operated during daytime hours. It has been determined that noise levels will be in compliance with the standards set forth in the Chinese and World Bank environmental guidelines. Sound levels produced by turbine operation will be naturally attenuated by ambient conditions and were determined to be within Chinese Standards (GB3096-93, GB12348-90, and GB12523-90) and World Bank Guidelines.

Impacts on Birds

Birds can collide with wind turbines as well as other structures that they have trouble seeing, including road traffic. Studies on existing wind power facilities in Europe and North America indicate that raptors and migratory waders are the most susceptible species. These species are less common near the windfarm sites. All sites have been selected with due consideration for avoiding migratory bird routes as well as areas with large bird populations. The sites were determined to pose no significant impacts for birds. Turbines will be erected on tubular towers (i.e., not lattice towers) to reduce perching sites for birds.

Visual Impacts

In several countries (most notably the United Kingdom), development of windfarms has met local opposition due to the visual effect of the turbines on the landscape. However in China, the wind turbines are considered an attraction and have served as the basis for a small tourism industry at the Huitengxile site in Inner Mongolia.

Interference with Communications—Turbine Blades

Turbine blades are capable of deflecting radio and microwaves used for communication purposes and can cause interference with television and radio broadcasting, microwave and cellular radio communications and various navigational and air traffic control systems. Blades made from metallic materials present the greatest potential for interference; fiberglass blades and wood blades (presently the most common blade materials) have lesser effects. Experience with existing turbines at the Huitengxile and Zhangbei sites show no effects on communication systems. If effects do surface, they can generally be corrected using inexpensive, directional receivers/transmitters.

Interference with Communications—Electrical Transmission and Distribution

Corona noise from electrical conductors interferes primarily with lower frequency signals normally associated with AM radio broadcasting. This noise is more problematic during rainstorms. The layouts for all transmission and distribution lines have been designed with due consideration for maintaining minimum distances between the lines and broadcasting and receiving stations, households, etc. In addition, the electric field strength from all transmission/distribution lines and substations has been investigated and compared to applicable Chinese standards (there are no World Bank guidelines for electric field intensity). The calculated field strength values fall within the Chinese guidelines. No interference is expected.

Land Use Impacts

Land acquired for turbine foundations will be permanently removed from its current use. However, the amount of land is minimal (about 600 mu, approximately 40 ha). An additional 1,132 mu (approximately 75 ha) will be temporarily occupied during construction of the windfarms. The temporarily and permanently occupied land is primarily used for husbandry and other agricultural purposes (Huitengxile and Zhangbei), serves as wind shelter belt (Fujian), or is land undergoing continual reclamation (Shanghai sites). The resulting productive land loss (i.e., crops for which farmers will be compensated in accordance with policies and regulations in China) is minimal. See Annex 9 (Land Acquisition and Resettlement) for a more complete description of the resettlement aspects of the Windfarm Component and Project.

Air Quality

Air quality impacts are limited to increased level of dust from use and movement of construction equipment. Increased dust levels are short-lived and localized. No significant impacts are expected.

Occupational Health and Safety

Project design will be such that international standards of worker health and safety will be included in the bidding documents of project equipment. Turbines will be designed to meet ASME (or equivalent) standards for safety and will be so specified in the bidding documents. Polychlorinated biphenyls (PCBs) are illegal in China; their use will be prohibited in the project. Prohibition of asbestos use will also be specified in the bidding documents.

B. Environmental Monitoring Mitigation and Cost

The tables below indicate the environmental monitoring and mitigation plans for the Windfarm Development Component. The total cost for the monitoring and mitigation plans at the five windfarms is Y 500,000 (approximately $60,000—see feasibility studies in project files for details)

Environmental Monitoring of Windfarm Component

Period	Key Environmental Issue	Responsible Institutions	Supervisory Agencies
Construction	Noise	Environmental management	Environmental Protection Bureau at provincial, city, and county level
	Land use impacts Air quality	Office of windfarm companies	
Operation	Noise	Environmental management	Environmental Protection Bureau at provincial, city, and county level
	Impact on Birds Interference with Communications—Blades Interference with Communications—Electrical Equipment Land use impacts	Office of windfarm companies	

Environmental Mitigation Measures and Costs of Windfarm Component

Period	Key Environmental Issue	Mitigation Measure	Responsible Institution	Supervisory Agencies
Construction	Noise	Heavy equipment to be operated during daytime hours and on windfarm site only.	Environmental Management Office of windfarm companies	Environmental Protection Bureau at provincial, city, and county level
	Land use impacts	Minimize land use. Only use designated acquired land. Return land to natural conditions. Compensation according to RAP.		
	Air quality	Dampen dirt roads.		
Operation	Noise	Sites selected with due consideration for adjacent villages, households, etc. In bidding documents, specify turbines with international standards for noise emissions.	Environmental Management Office of windfarm companies	Environmental Protection Bureau at provincial, city, and county level
	Impact on Birds	Sites selected with due consideration of migratory bird paths and local bird populations. Turbines to be mounted on tubular towers to minimize perching opportunities.		
	Interference with Communications • Blades	Use of directional receivers/transmitters.		
	• Electrical Equipment	Layout of electrical equipment maintains acceptable minimum distances with households, other buildings, etc.		
	Land use impacts	Only access roads (based on acquired land) will be used to service turbines.		

Annex 11: Agreements Reached with PMO on Direct Grant Under PV Component

China: Renewable Energy Development Project

Grant Disbursement

Each participating company will receive a grant of $1.50 per Wp for each eligible system sold in the Project market areas. This section sets forth the eligibility criteria for: (a) companies, (b) products; (c) market areas; (d) customers and (e) sales dates. It also describes the procedures for approving a PV company's participation in the Project and for grant payments, including arrangement for escrow accounts.

Grant Eligibility Criteria

Eligible PV Companies. Participation will be open to companies who meet the following criteria.

To be eligible to receive GEF grants, a PV company must initially meet, and continue to meet, the following criteria:

(a) have operations that include sales of PV systems in the eligible areas;
(b) have annual, audited accounts that include its PV systems sales;
(c) be financially viable;
(d) prepare a business plan acceptable to the Bank that demonstrates that:
- the PV systems sold would meet the Project's technical specifications;
- the company's operations would be commercially viable;
- the company has made arrangements to increase its sales either by expanding its service network or by increasing marketing efforts in existing market areas;
- the company would abide by adequate consumer protection plans, including a returns policy, warranties, and adequate after-sales service networks;
- the company agrees to establish an escrow account that would be used in the event of its failure to comply with the eligibility criteria; and
- the company has a system to provide data required for project monitoring by PMO. The company would retain documentation for the full period of the warranty of each PV module sold. It would also allow access to representatives of the PMO or others designated by the Bank, to its customer data base, including records of sales, installations, collections, complaints, repairs and warranties.

(e) agree to abide by competitive code of norms for dealing with customers, employees, and other companies, including:
- providing customers with complete and correct information about products, services and prices;
- competing openly, not engaging in actions that might prevent competitors from entering or operating in particular market areas.

Eligible Equipment. Any PV system sold, with a PV module of 10 Wp and larger, including PV/wind hybrid systems, is eligible to receive the grant for the PV module throughout the project life so long as the system meets specifications. The applicable specifications are *Solar Photovoltaic Systems and Photovoltaic Hybrid Systems Specifications and Qualifying Requirements,* December 1998 or later version.

The following institutions have been accredited for the certification testing of components:
- Shanghai Institute for Space Power Sources and Tianjin Institute for Power Sources: PV Modules;
- Postal & Telecommunications Industry Standardization Institute: Battery, Inverter, and Controller;

- China Certification & Testing Station for Lighting Electrical Products (Beijing): DC Lights; and
- Beijing Badaling Wind Turbine Testing Field, Wind Turbine Hohhot Livestock Machinery Research Institute: Wind Turbine and Wind Turbine Controller.

Other qualified organizations will be considered on a case-by-case basis by the PMO. In general, organizations accredited according to ISO-25 requirements will be acceptable.

Eligible Markets. The initial geographical focus for qualifying sales is Qinghai, Gansu, Inner Mongolia, Tibet, Xinjiang and western Sichuan, and adjacent areas.

Eligible Customers. Qualifying sales are final sales to eligible customers. Eligible customers are individual households, shops and other businesses, and local county and lower-level institutions and community groups in the eligible market areas.

Eligible Sales Dates. Qualifying sales are those made after the World Bank has issued its no-objection letter to the PMO for the participation of the PV company in the project. Grant payments may be requested by the PV companies from the PMO no later than six months prior to the closing date of the project.

Other Subsidies. The project grant support is intended to support market development. Grants will not be paid for sales or to companies that benefit from other subsidies if these other subsidies benefit one or several companies over other companies or in other ways distort or hamper market development.

Procedures for Approving a PV Company's Participation in the Project

The steps for approving a PV company's participation in the project are as follows:
- Company applies to the PMO to participate in the Project.
- PMO appraises the company's business plan and other documents to determine whether they are complete and conform with project requirements.
- If acceptable, the PMO forwards a summary of the key information on the company and the financial projections to the Bank, requesting the Bank's to confirm the acceptability of the company's participation in the project.
- After a satisfactory review, the Bank issues a letter indicating no objection to the company's participation.
- Upon receipt of the Bank's no-objection letter, the PMO enters into a grant contract with the PV company.

Procedures for Grant Payments, including Escrow Account

There would be a subsidiary grant agreements between SETC/PMO and each company. Grant payment requests would be made by the companies to the PMO. The PMO would review the documentation and, if complete and in compliance with the requirements, would authorize the payment.

The PMO authorization procedure for grant payments would be as follows:
- Customer signs the PV system acceptance receipt, which gives details of the PV system including the serial number of the PV module, the owners name and address.
- PV company makes a grant payment request to the PMO. The request would be sent at agreed intervals (e.g., one month) and in agreed minimum size batches (e.g., 50 units or $1,000) to the PMO along with its request for grant payment.

- Local PV module manufacturers send the PMO details of modules shipped to the PV system company. Imported modules have shipping documents with this information. The required details include module Wp rating, serial number of each module and date of shipment.
- PMO verifies that the modules reported as sold came from a shipment of a qualified manufacturer. This verification is intended to prevent companies from attempting to obtain multiple grants per module and is one check on quality.
- PMO audits 25 sales reported by each company to verify sale and confirm compliance with specifications, before authorizing grant payment for the first time.
- PMO authorizes grant payments after satisfactory results of audit.
- PMO authorizes subsequent grant payments as described above, while conducting random audits, as necessary, to confirm that reported sales meet project requirements.

Escrow Account. An escrow account would be established. There would be a contract agreement setting out the terms and conditions of the escrow account. This agreement would be acceptable to the Bank.

The escrow account would be funded by deposits equivalent to a small percentage of the authorized grant payments (4 percent in year 1, 3 percent in year 2, 2 percent in year 3, 1 percent in year 4 and subsequent years). The purpose of the escrow account fund is to serve as an incentive to the PV company to continue to comply with project requirements and to support remedial measures to assist customers in the event that a PV company failed to honor its warranty or other consumer protection commitments under the project.

The funds in the escrow would be used by the PMO with the concurrence of the Bank only after the Bank has agreed that a PV company is excluded from the project due to failure to meet its obligations under the project. If a company is not excluded with the Bank's concurrence, the full control over the funds in the escrow account would revert automatically to the PV company on the date six months prior to the closing date of the Project.

PMO Responsibilities

A project management office (PMO) has been set up within SETC to manage implementation. A Director of the PMO, acceptable to the Bank, will be nominated by SETC prior to Project effectiveness. The PMO carries out the following tasks:

- authorizes payments from the Special Account;
- enters into grant agreements with PV companies as well as other grant agreements and contracts;
- maintains the Project accounts;
- maintains the management information system;
- confirms whether equipment meets the project's technical specifications;
- verifies that sales and installations are in compliance with project requirements;
- manages market development program and product quality assurance;
- monitors and reports on project implementation and issues project financial reports;
- liaises and communicates directly with all project stakeholders, other related project entities, local and central government agencies and the Bank; and
- facilitates Bank supervision missions and takes follow-up actions as agreed.

The PMO will be staffed with several full-time national experts, including SETC staff, and assisted by short-term national and international experts. The key staffing and organization will be as follows:

- **Financial Management, Accounting and Contract Documentation Section.** This section has the responsibility to ensure that project funds are prudently managed, that expenditures and activities are well-documented and that internal procedures and controls are in compliance with the requirements of the World Bank/GEF and GOC.

- **Verification Section.** The section is responsible for confirming that equipment meets the technical specifications and the PV system are in compliance with project requirements. This section will also follow up on complaints received from customers or others.
- **Institutional Section.** This section will be responsible for coordinating the market development activities, project reporting, overseeing market development and quality improvement efforts, monitoring market development, and preparing annual plan for the Market Development Program.
- **Key Consultants.** International and local consultants are expected to be used at the level of effort provided for in the budget. The annual work plans will include the consultant work plans and schedules for the year.

Compliance and Performance Monitoring

The PMO will monitor participating companies to ensure that: (a) grant funds are being used for the intended purpose; (b) the companies are complying with pre-established technical after-sales service, and consumer protection standards; and (c) customers are satisfied with their PV systems.

Verifying that the PV companies are complying with the project requirements is the primary responsibility of the verification section of the PMO. The PMO will act on two kinds of noncompliance. In the case of isolated incidents, the PMO will give the company the opportunity to remedy the problem within a given time limit. In the case of fraud or repeated incidents or technical and management failings, the PMO would notify the Bank, obtain its no objection, and notify MOF to suspend disbursements to the company and take other actions to terminate the company's participation in the project.

Monitoring methods for this component would include the following:
- end-user level audits of 25 systems sold by each company;
- random, unannounced, independent end-user level audits of subsequent sales, as needed;[1]
- customer surveys using simple, short postcards and questionnaires;
- provision of a free consumer hotline;
- small focus group sessions with companies and consumers to monitor market;
- complaint based end-user audits;
- reviews of reports provided by PV companies, local and international suppliers and others;
- direct observation and verification during regular field visits;
- annual reviews of the audited financial statements of each company, including counteraudits; and
- as needed, performance reviews with companies, their accountants, auditors and discussion of ways to improve the compliance monitoring system.

In addition the Verification Section of the PMO, in collaboration with the product quality assurance and market development staff, will conduct technical performance audits of PV systems or components.

PV Component—Reporting

PV Companies to PMO. The main approach to company reporting requirements is that they should be the *minimum* necessary to verify sales and installations for which GEF payments are made and to monitor SHS market development. Additional information gathered through company visits and reviews of the annual audited statements of the companies will be conducted by the PMO to monitor the overall progress in developing sustainable enterprises.

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[1] These are *ex-post* verifications done on a routine basis. This permits grant payments to the PV companies to continue without hindrance. The sampling methodology is determined by the PMO.

Quarterly, within one month of the end of the quarter, the participating PV companies will report to the PMO. The report will include three tables (table formats have been prepared and will be approved during the approval of the first annual work plan before project effectiveness):

- GEF grant payment tracking report of the company's requests to the PMO for GEF grant payments and of receipts of grant payments. (Note: All forms are in the PIP, annex K. Form 1 is used by the PV companies when submitting a grant payment request to the PMO.)
- report on company's unit PV system sales during the period by Wp size and province. In addition to the table, the companies should indicate in text the main factors affecting their sales.
- report on company's purchases of PV modules, batteries and other system components during the period.

Annually, the companies will submit to the PMO copies of their audited financial statements no later than the end of March of the following year.

PMO to IBRD. On an informal basis the PMO will send reports on a quarterly basis to the Bank, within three months of the end of the quarter. This may become a formal requirement depending on the requirements that may be agreed from time to time during implementation. The quarterly reporting is to permit the Bank to stay abreast of progress, alert the Bank to actions for which PMO will be requesting Bank decisions, and provide the Bank with an early warning of potential issues and recommendations. The process of preparing the quarterly report can also be an internal management tool for the PMO to assess progress and address implementation constraints as may be required.

The informal quarterly report of the PMO will consist of five tables generated by the management information system and one brief narrative statement. These are the following:

- summary report on total PV system unit and Wp sales by size of unit and province, based on the reports submitted by the PV companies;
- GEF grant payment requests received and payments authorized by the PMO, by company, province, units and value;
- GEF grant payment requests submitted and payments received by the PV companies, by company and province, in number of units and value, based on reports submitted by companies;
- information on end-user verifications completed of the PV system sales and installations, by company;
- GEF payment requests received and authorized by PMO by date; and
- statement on urgent issues and recommendations for adjustments to improve implementation performance.

Biannually, the PMO will send a report to the Bank that will include the above tables and statement, plus:

- statement of the results and status of completed, ongoing and upcoming PMO activities, including the Market Development Program and Quality Assurance Program. The format for this will be approved at the time of approving the first annual work plan.
- statement on the main trends and factors affecting PV market development and the companies participating in the project.
- progress report against key performance indicators and milestone dates. The indicators are consistent with the PAD. The table format for this will be approved at the time of approving the first annual work plan. The indicators will include:
  - cumulative systems sold;
  - installed MWp;
  - installed cost in $/Wp;
  - PV systems sold and operating under project in units;

  - PV systems sold and operating under project in MWp; and
  - number of PV companies with satisfactory quality control systems in place.
- PMO's PV related current organization chart; and
- standard financial management, contracts and procurement reporting tables as agreed between the Bank's Resident Mission and MOF. The financial reports will be generated by the financial management information system, which is being developed by the Bank. The financial reporting on expenditures will follow the budget line items and sublines as agreed, which will be included in the PIP. These reports are:

  Financial
  - balance sheet
  - statement of sources and uses of funds
  - special account statement
  - statement of implementation of GEF grant agreement

  Contracts
  - contract expenditure report: consultants
  - contract expenditure report: goods

  Procurement
  - procurement management report: consultants
  - procurement management report: goods and works

Annually, the PMO will issue a summary report on the financial performance of the participating PV companies. This report should be submitted to the Bank within 6 months of the reporting year-end. This analysis will take into account the audited financial statements submitted by the companies, data from project information maintained by the PMO, and information gathered during company visits, consumer and company focus groups and discussions with other knowledgeable sources, which might include representatives of commercial banks and suppliers. This report will compare estimated financial performance of the companies against the performance indicators included in the PAD.

The PMO will prepare the Project Implementation Completion Report 6 months before the closing date of the Project.

Annex 12: Project Processing Budget and Schedule

China: Renewable Energy Development Project

A. Project Budget ($000)	Planned (At final PCD stage)	Actual (As of 05/05/99)
Bank	391.0/a	319.0
GEF	396.7/b	412.7
B. Project Schedule	**Planned (At final PCD stage)**	**Actual (As of 05/05/99)**
Time taken to prepare the project (months)		24
First Bank mission (identification)	n.a.	04/24/97
Appraisal mission departure /c	01/15/99	06/29/98
Negotiations	03/22/99	04/12/99
Planned Date of Effectiveness	09/01/99	n.a.

Prepared by: State Economic and Trade Commission/State Power Corporation

Preparation assistance: GEF; PPF; PHRD; TF

Bank staff who worked on the project included:

Name	Specialty
N. Berrah	Economist
S. Bogach	Economist
A. Cabraal	Energy Specialist
C. Garstang	Lawyer
E. Heijndermans	Alternative Energy Expert
T. Johnson	Economist
S. Piscitello	Renewable Energy Engineer
J. Cornelis Post	Ecologist
T. Shen	Financial Management Specialist
E. Sun	Financial Analyst
C. Zhang	Resettlement Specialist
J. Zhao	Energy Specialist
Quality Assurance Team	
R. Spencer	Renewable Energy Specialist
R. Hansen	Consultant on PV Business Development
A. Baietti	Financial Analyst

/a Limit of $400,000 set by the Country Director.
/b Planned budget was increased from $396,700 at final PCD stage to $458,000 at appraisal stage.
/c Preappraisal mission upgraded to appraisal mission, see Project Appraisal Completion Memo of December 3, 1998.

Annex 13: Documents in the Project File

China: Renewable Energy Development Project

A. Basic Documents for Project Implementation

1. PIP for Windfarm Component (Draft October 1998, Revised April 1999)
2. PIP for PV Component (Draft October 1998, Revised April 1999)
3. PIP for TI Component (Draft December 1998, Revised April 1999)

B. Bank Staff Assessments

1. Project Concept Document (July 1997)

C. Documents Related to the Wind Component

1. Standard Power Purchase Contract between a Power Company and a Wind Power Company. Second Draft, (January 1999)
2. China Renewable Energy Project: Tariff Structures for Windfarm Projects, (July 1998)
3. Shanghai (Chongming, Nanhui) Wind Power Generation Project. Specialized Report of Resettlement Action Plan (August 1998)
4. Zhangbei Windfarm, The Residents Resettlement Action Plan (October 1998)
5. Huitengxile Windfarm, The Residents Resettlement Action Plan (October 1998)
6. Pingtan Wind Power Project, Resettlement Action Plan (October 1998)
7. Feasibility Study of Shanghai (Chongming, Nanhui) Wind Power Generation Project (including environmental analysis) (August 1998)
8. Zhangbei Windfarm, Feasibility Study (including environmental analysis) (August 1998)
9. Huitengxile Windfarm, Inner Mongolia, Feasibility Study (including environmental analysis) (August 1998)
10. Revised Feasibility Study Report of Pingtan Wind Power Station (including environmental analysis) (August 1998)
11. Financial Analysis Windfarms (August 1998, Revised January 1999) Supplementary analysis on revised covenant and on alternative financing of foreign exchange, April 1999.
12. Economic Analysis on China Renewable Energy Development Project Windfarm Component (final report) Vol. 1 and 2. (November 1998)
13. Terms of Reference for Institutional Strengthening (August 1998)

D. Documents Related to the PV Component

1. Solar Photovoltaic Systems and Photovoltaic/Wind Hybrid Systems Specifications and Qualifications and Qualification Requirements, (December 1998)
2. Calculations CO_2 Emissions Avoided Estimates for Wind and PV
3. Summary Report of PV Company Preselection (May 1998)
4. Summary Report on PV Business Planning Workshop (June 1998)
5. Test Procedures for Certifying Controllers, Inverters and Lights (March 1999)
6. Market Survey in Four Provinces (Draft May 1999, Final planned June 1999)
7. Detailed Financial Analysis for PV Component (November, 1999)
8. Business Plans for 17 Participating Companies (October 1998)
9. PV-Systems China. Test Results and Proposed Modifications, part 1 (draft)(September 1998)

E. Documents Related to the TI Component

1. Survey Report for PV Industry in China (December 1998)
2. The Survey Report of Wind Industry (Grid Connected) in China. (December 1998)
3. Outline of the Technology Improvement Program (October 1998)
4. Design of a Technology Development Program (June 5, 1998)

F. General

1. China, A Strategy for International Assistance to Accelerate Renewable Energy Development. World Bank Discussion Paper, No. 388 (1998)
2. China, Renewable Energy for Electric Power, World Bank Report No. 15592-CHA (Sept. 1996)
3. Financial Incentives for Renewable Energy Development, World Bank Discussion Report No. 391 (1998)

Annex 14: Statement of Loans and Credits

Status of Bank Group Operations in China, as of March 31, 1999

Project ID	Fiscal Year	Borrower	Purpose	Original Amount in $ Millions IBRD	IDA	Cancel.	Undisb.	Difference Between expected and actual disbursements Orig	Frm Rev'd	Last PSR Supervision Rating /a Dev Obj	Imp Prog
Number of Closed Projects: 106											
Active Projects											
CN-PE-3568	1992	R.O.C.	Tianjin Urb Dev & En	0.00	100.00	0.00	18.33	15.24	-2.50	HS	S
CN-PE-3624	1992	Min. of Public .Health	Infectious Diseases	0.00	129.60	0.00	31.49	26.83	26.79	HS	S
CN-PE-3565	1992		Shanghai Metro Trans	0.00	60.00	1.69	1.32	-.08	0.00	S	S
CN-PE-3503	1992		Zouxian Thermal Powe	310.00	0.00	0.00	7.79	7.80	0.00	S	S
CN-PE-3534	1992	PRC	Zhejiang Prov Transp	220.00	0.00	0.00	19.91	19.92	12.42	S	S
CN-PE-3564	1992	Beijing Municipality	Beijing Environment	45.00	80.00	0.00	25.28	20.02	8.32	S	S
CN-PE-3632	1993	ROC	Environment Tech Ass	0.00	50.00	0.00	10.71	11.06	.03	S	S
CN-PE-3616	1993	PRC	Tianhuangping Hydro	300.00	0.00	0.00	65.95	49.37	0.00	S	HS
CN-PE-3623	1993	PRC	Financial Sector T.A	0.00	60.00	0.00	19.16	16.21	0.00	S	S
CN-PE-3597	1993	PRC	Taihu Basin Flood Co	100.00	100.00	0.00	47.43	43.08	0.00	S	S
CN-PE-3580	1993	PRC	So.Jiangsu Environ. Protect.	250.00	0.00	0.00	4.15	-.31	0.00	S	S
CN-PE-3581	1993	PRC	Henan Prov. Transport	120.00	0.00	0.00	9.59	9.60	0.00	S	S
CN-PE-3570	1993	PRC	Railway VI	420.00	0.00	0.00	94.61	93.62	0.00	S	S
CN-PE-3561	1993	PRC	Sichuan ADP	0.00	147.00	0.00	5.49	0.00	0.00	S	S
CN-PE-3533	1993		Tianjin Ind. II	150.00	0.00	40.35	13.59	44.43	7.93	S	S
CN-PE-3512	1993	Govt of Peoples Rep. of China	Shanghai Port Rest.	150.00	0.00	25.74	3.88	29.10	2.86	S	S
CN-PE-3518	1993	PRC	Guangdong Prov. Transport	240.00	0.00	0.00	2.08	-.94	0.00	S	S
CN-PE-3627	1993	PRC	Grain Distribution P	325.00	165.00	0.00	325.46	322.19	86.20	S	U
CN-PE-3592	1993	PRC	Ref. Inst'l.& Preinv	0.00	50.00	0.00	18.47	18.48	0.00	HS	NA
CN-PE-3567	1993	PRC	Effective Teaching S	0.00	100.00	0.00	9.59	7.98	8.04	S	S
CN-PE-3559	1993	PRC	Agric. Support Servi	0.00	115.00	0.00	10.41	-1.50	0.00	S	S
CN-PE-3473	1993	PRC	Zhejiang Multicities	0.00	110.00	0.00	19.79	19.17	0.00	S	S
CN-PE-3644	1994	PRC	Xiaolangdi Resettlement	0.00	110.00	0.00	25.56	8.87	0.00	S	S
CN-PE-3633	1994	Government of PRC	Telecommunications	250.00	0.00	30.00	15.27	45.27	0.00	HS	HS
CN-PE-3622	1994	Shanghai Municipal Govt	Shanghai Mtp II	150.00	0.00	0.00	7.36	7.37	0.00	S	S
CN-PE-3595	1994	PRC	Red Soils Ii Develop	0.00	150.00	0.00	40.36	16.45	0.00	S	S
CN-PE-3586	1994	PRC	Shanghai Environment	160.00	0.00	0.00	62.73	57.29	0.00	S	S
CN-PE-3557	1994	PRC	Forest Resource Dev	0.00	200.00	0.00	40.47	13.01	-32.36	S	S
CN-PE-3504	1994	PRC	Hebei/Henan National	380.00	0.00	0.00	48.65	15.63	0.00	S	S
CN-PE-3641	1994	PRC	Yangzhou Thermal Pow	350.00	0.00	0.00	74.09	57.77	0.00	S	S
CN-PE-3609	1994	GOC	Sichuan Gas Dev & Conservation	255.00	0.00	0.00	122.62	71.13	0.00	S	U
CN-PE-3562	1994	PRC	Xiaolangdi Multipurpose	460.00	0.00	0.00	.83	.83	0.00	HS	S
CN-PE-3502	1994	MOH	Rur Health Manpower	0.00	110.00	0.00	29.62	24.07	0.00	U	S
CN-PE-3540	1994	PRC	Loess Plateau	0.00	150.00	0.00	27.96	-23.21	0.00	S	S
CN-PE-3593	1994	PRC	Songliao Plain ADP	0.00	205.00	0.00	25.39	-12.80	0.00	HS	S
CN-PE-3626	1994	GOC	Fujian Prov Highway	140.00	0.00	0.00	58.63	36.62	8.35	HS	HS
CN-PE-37156	1995	PRC	Iodine Def. Disorder	7.00	20.00	7.00	1.91	11.57	-.19	HS	S
CN-PE-36041	1995	MOF	Fiscal & Tax Ref. &	50.00	25.00	0.00	66.31	41.61	0.00	S	U
CN-PE-3642	1995		Zhejiang Power Devt	400.00	0.00	0.00	136.50	-44.02	0.00	S	HS
CN-PE-3636	1995	PRC	Basic Educ In Poor &	0.00	100.00	0.00	3.39	-1.46	0.00	S	S
CN-PE-3493	1995	PRC	Inland Waterways	420.00	0.00	0.00	275.02	-9.54	0.00	S	S
CN-PE-3612	1995	PRC	Xinjiang Highway I	150.00	0.00	0.00	47.85	37.86	0.00	S	S
CN-PE-3600	1995	PRC	Technology Developme	200.00	0.00	0.00	125.74	43.65	0.00	S	S
CN-PE-3596	1995	PRC	Yangtze Basin Water	100.00	110.00	0.00	35.28	-12.19	0.00	S	S
CN-PE-3571	1995	PRC	Railways VII	400.00	0.00	29.00	344.67	201.66	-2.97	S	S
CN-PE-3639	1995	PRC	Southwest Pov. Reduc	95.00	200.00	0.00	143.78	32.70	0.00	HS	S
CN-PE-3598	1995		Liaoning Environment	110.00	0.00	0.00	70.21	58.65	0.00	S	S
CN-PE-3647	1995	PRC	Economic Law Reform	0.00	10.00	0.00	5.51	5.59	0.00	S	S
CN-PE-36947	1995	GOC	Sichuan Transmission	270.00	0.00	0.00	132.50	119.80	80.99	S	S
CN-PE-3603	1995	PRC	Ent. Housing Soc. Se	275.00	75.00	20.00	199.84	155.96	7.94	HS	S
CN-PE-3585	1995	GOC	Shenyang Ind. Reform	175.00	0.00	0.00	97.54	49.74	0.00	S	S
CN-PE-3634	1995	PRC	Maternal Child Healt	0.00	90.00	0.00	18.42	8.84	0.00	HS	HS
CN-PE-40513	1996	PRC	2nd Henan Prov Hwy	210.00	0.00	0.00	175.14	51.14	0.00	S	S
CN-PE-34618	1996	PRC	Labor Market Dev.	10.00	20.00	0.00	24.00	22.16	0.00	S	S
CN-PE-3649	1996	CHINA	Shanxi Poverty Allev	0.00	100.00	0.00	34.56	-8.05	0.00	S	S
CN-PE-3646	1996	PRC	Chongqing Ind Pol Ct	170.00	0.00	77.99	91.22	102.45	0.00	S	U
CN-PE-3602	1996	PRC	Hubei Urban Env. Pro	125.00	25.00	0.00	123.98	76.31	0.00	U	U
CN-PE-3594	1996	PRC	Gansu Hexi Corridor	60.00	90.00	0.00	125.65	26.19	0.00	S	S
CN-PE-3563	1996	PRC	Animal Feed	150.00	0.00	0.00	138.78	110.45	18.79	S	S
CN-PE-3569	1996	PRC	Shanghai-Zhejiang Hi	260.00	0.00	7.75	110.73	32.49	22.50	S	S
CN-PE-3507	1996	GOC	Ertan Hydro II	400.00	0.00	0.00	25.23	-22.55	0.00	S	HS
CN-PE-3652	1996	PRC	2nd Shaanxi Prov Hwy	210.00	0.00	0.00	139.29	51.28	0.00	S	S
CN-PE-36950	1996	PRC	Basic Ed. Poor III	0.00	100.00	0.00	11.93	-20.76	0.00	S	S

Project ID	Fiscal Year	Borrower	Purpose	Original Amount in $ Millions				Difference Between expected and actual disbursements		Last PSR Supervision Rating /a	
				IBRD	IDA	Cancel.	Undisb.	Orig	Frm Rev'd	Dev Obj	Imp Prog
CN-PE-3638	1996	PRC	Seeds Sector Commer.	80.00	20.00	0.00	80.15	27.70	0.00	S	S
CN-PE-3589	1996	PRC	Disease Prevention	0.00	100.00	0.00	69.06	58.11	0.00	S	S
CN-PE-3648	1996	Shanghai Mun. Govt	Second Shanghai Sewe	250.00	0.00	0.00	157.96	76.95	0.00	S	S
CN-PE-3599	1996	Yunnan Prov. Gov.	Yunnan Environment	125.00	25.00	0.00	139.13	18.15	0.00	U	S
CN-PE-44485	1997		Shanghai Waigaoqiao	400.00	0.00	0.00	400.00	53.05	0.00	S	S
CN-PE-38988	1997	PRC	Heilongjiang ADP	120.00	0.00	0.00	93.02	8.38	0.00	S	S
CN-PE-36405	1997	PRC	Wanjiazhai Water Tra	400.00	0.00	0.00	320.09	5.08	0.00	S	S
CN-PE-3654	1997	PRC	Hunan/Guang Hwy 2-NH2	400.00	0.00	0.00	336.64	86.62	0.00	S	S
CN-PE-3643	1997	PRC	Xinjiang Highways II	300.00	0.00	0.00	230.72	57.72	0.00	S	S
CN-PE-3635	1997	PRC	Voc. Ed. Reform Proj	10.00	20.00	0.00	15.19	1.30	0.00	S	S
CN-PE-34081	1997	PRC	Xiaolangdi Multi. II	430.00	0.00	0.00	331.51	89.27	0.00	HS	S
CN-PE-3590	1997	PRC	Qinba Mts. Povty Red	30.00	150.00	0.00	148.35	23.88	0.00	S	S
CN-PE-3637	1997	PRC	Natl Rur Water III	0.00	70.00	0.00	62.10	10.38	0.00	S	S
CN-PE-36952	1997	PRC	Basic Ed. IV	0.00	85.00	0.00	41.37	-26.19	0.00	S	S
CN-PE-3650	1997	GOC	Tuoketuo Power/Inner	400.00	0.00	0.00	394.61	137.17	0.00	S	S
CN-PE-56491	1998	PRC	Hebei Earthquake	0.00	28.40	0.00	10.66	-9.81	0.00	HS	HS
CN-PE-49700	1998	PRC	IAIL-2	300.00	0.00	0.00	280.00	3.30	0.00	S	S
CN-PE-46563	1998	PRC	Tarim Basin II	90.00	60.00	0.00	140.76	5.11	0.00	S	S
CN-PE-35698	1998	PRC	Hunan Power Develop.	300.00	0.00	0.00	300.00	9.00	0.00	S	S
CN-PE-40185	1998	PRC	Shandong Environment	95.00	0.00	0.00	92.00	21.75	0.00	S	S
CN-PE-36414	1998	China	Guangxi Urban Env.	72.00	20.00	0.00	88.83	-1.20	0.00	S	S
CN-PE-3619	1998	Ministry Of Finance	2nd Inland Waterways	123.00	0.00	0.00	123.00	18.50	0.00	S	S
CN-PE-3606	1998	GOC	Energy Conservation	63.00	0.00	0.00	63.00	2.87	0.00	S	S
CN-PE-3566	1998		Basic Health	0.00	85.00	0.00	81.99	.05	0.00	S	S
CN-PE-3591	1998	PRC	State Farms Commerci	150.00	0.00	0.00	102.59	-32.91	0.00	S	S
CN-PE-3614	1998	People's Republic of China	Guangz. City Crt.Trp	200.00	0.00	0.00	192.00	5.61	0.00	S	S
CN-PE-51736	1998	GOC	E. China/Jiangsu Pwr	250.00	0.00	0.00	250.00	92.38	0.00	S	S
CN-PE-45788	1998	People's Republic of China	Tri-Provincial Hwy	230.00	0.00	0.00	230.00	39.70	0.00	S	S
CN-PE-46952	1998	PRC	Forest. Dev. Poor Ar	100.00	100.00	0.00	200.81	8.50	17.00	S	S
CN-PE-3539	1998	PRC	Sust Coast Res Dev	100.00	0.00	0.00	96.00	-.25	0.00	S	S
CN-PE-36949	1998	Peoples Republic of China	Nat.Hwy 3-Hubei	250.00	0.00	0.00	242.00	12.00	0.00	S	S
CN-PE-63123	1999	PRC	Yangtze Flood Emergy	40.00	40.00	0.00	79.21	0.00	0.00		
CN-PE-49665	1999	PRC	Anning Valley Ag.Dev	90.00	30.00	0.00	119.03	0.00	0.00	S	S
CN-PE-50036	1999	People's Republic of China	Anhui Provincial Hwy	200.00	0.00	0.00	200.00	7.45	0.00	S	S
CN-PE-41890	1999	People's Republic of China	Liaoning Urb Transp	150.00	0.00	0.00	150.00	0.00	0.00		
CN-PE-51856	1999	Ministry of Finance	Accntg Reform & Dev	27.40	5.61	0.00	32.96	1.36	0.00		
CN-PE-3653	1999	People's Republic of China	Container Transport	71.00	0.00	0.00	71.00	0.00	0.00	S	S
Total				**14,868.40**	**3,995.61**	**239.52**	**10,014.74**	**3,002.08**	**270.14**		

	Active Projects	Closed Projects	Total
Total Disbursed (IBRD and IDA):	8,558.59	12,529.50	21,088.09
of which has been repaid:	73.75	2,515.23	2,588.98
Total now held by IBRD and IDA:	18,550.68	9,648.52	28,199.20
Amount sold :	0.00	0.00	0.00
Of which repaid :	0.00	0.00	0.00
Total Undisbursed :	10,014.74	21.95	10,036.69

/a Intended disbursements to date minus actual disbursements to date as projected at appraisal.

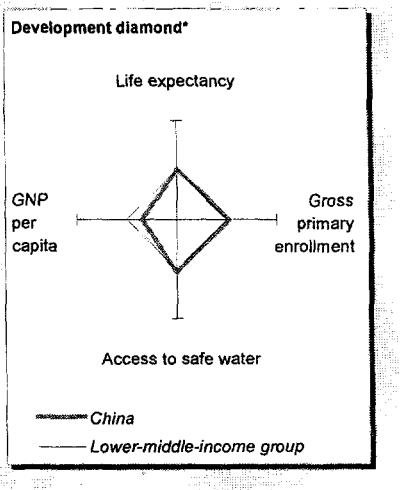
Statement Of IFC's Committed And Disbursed Portfolio
As of March 31, 1999 (In $ Millions)

FY		Committed				Disbursed			
		IFC				IFC			
Approval	Company	Loan	Equity	Quasi	Partic	Loan	Equity	Quasi	Partic
0	Pacific Ports	0.00	3.64	0.00	0.00	0.00	3.64	0.00	0.00
1987/92/94	China Bicycles	8.50	3.39	0.00	0.00	8.50	3.39	0.00	0.00
1993	Shenzhen PCCP	3.76	.99	0.00	0.00	3.76	.99	0.00	0.00
1993	Yantai Cement	13.51	1.95	0.00	7.22	13.51	1.95	0.00	7.22
1994	China Walden JV	0.00	6.00	0.00	0.00	0.00	3.53	0.00	0.00
1994	China Walden Mgt	0.00	.01	0.00	0.00	0.00	.01	0.00	0.00
1994	Dalian Glass	20.50	2.40	0.00	40.50	20.50	2.40	0.00	40.50
1994	Dynamic Fund	0.00	12.35	0.00	0.00	0.00	10.08	0.00	0.00
1994/97	PTP Leshan	11.20	1.00	0.00	14.00	11.20	1.00	0.00	14.00
1995	Dupont Suzhou	23.36	4.15	0.00	46.80	23.36	4.15	0.00	46.80
1995	Newbridge Inv.	0.00	7.19	0.00	0.00	0.00	3.89	0.00	0.00
1995	Suzhou PVC	22.00	2.48	0.00	22.20	22.00	2.48	0.00	22.20
1996	Beijing Hormel	4.64	.50	0.00	4.95	4.64	.50	0.00	4.95
1996	Jingyang	40.00	0.00	0.00	100.00	40.00	0.00	0.00	100.00
1996	Nanjing Kumho	15.03	3.81	0.00	42.73	12.66	3.81	0.00	35.98
1996	Tianjin Kumho	11.17	0.00	0.00	33.00	0.00	0.00	0.00	0.00
1996	Weihai Weidongri	3.83	0.00	0.00	0.00	3.83	0.00	0.00	0.00
1997	Ningbo	0.00	2.00	0.00	0.00	0.00	2.00	0.00	0.00
1997	Orient Finance	13.33	0.00	0.00	16.67	13.33	0.00	0.00	16.67
1997	PTP Hubei	12.63	0.00	0.00	25.38	10.96	0.00	0.00	22.04
1997	Rabobank PTPC	2.40	0.00	0.00	2.40	0.00	0.00	0.00	0.00
1998	Caltex Ocean	21.00	0.00	0.00	45.00	16.23	0.00	0.00	34.77
1998	Chengxin-IBCA	0.00	.36	0.00	0.00	0.00	0.00	0.00	0.00
1998	Leshan Scana	6.10	1.35	0.00	0.00	0.00	0.00	0.00	0.00
1998	Rabobank SHFC	2.75	0.00	0.00	2.75	2.25	0.00	0.00	2.25
1998	Zhen Jing	0.00	2.00	0.00	0.00	0.00	2.00	0.00	0.00
	Total Portfolio:	235.71	55.57	0.00	403.60	206.73	45.82	0.00	347.38

		Approvals Pending Commitment			
		Loan	Equity	Quasi	Partic
1998	Chengdu Chemical	7.40	3.20	0.00	8.60
1997	CHINEFARGE	12.80	0.00	0.00	20.00
1998	EURECA	0.00	3.00	0.00	0.00
1998	Jiangsu Coline	6.50	0.00	0.00	0.00
1997	Nissan/Dongfeng	20.20	0.00	0.00	27.00
1998	Orient Fin A Inc	3.33	0.00	0.00	0.00
1997	PTP Holdings	0.00	1.50	0.00	0.00
1998	Shanghai Krupp	30.00	0.00	0.00	78.44
1997	SMC	14.00	0.00	0.00	14.00
1996	Tianjin	9.10	0.00	0.00	9.10
1998	Wuhan Cig	0.00	1.50	0.00	0.00
1998	Wuhan Port	5.00	0.00	0.00	5.00
1998	XIB	50.00	20.00	0.00	0.00
1998	Zhejiang Coline	6.50	0.00	0.00	0.00
1998	Zhen Jing	4.50	0.00	0.00	0.00
	Total Pending Commitment:	169.33	29.20	0.00	162.14

Annex 15: Country at a Glance

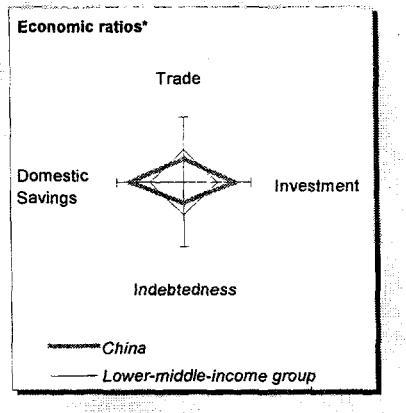
POVERTY and SOCIAL	China	East Asia & Pacific	Lower-middle-income
1997			
Population, mid-year *(millions)*	1,227.2	1,751	2,283
GNP per capita *(Atlas method, US$)*	860	970	1,230
GNP *(Atlas method, US$ billions)*	1,055.4	1,700	2,803
Average annual growth, 1992-98			
Population *(%)*	1.0	1.3	1.2
Labor force *(%)*	1.1	1.6	1.5
Most recent estimate (latest year available, 1992-98)			
Poverty *(% of population below national poverty line)*	7	..	..
Urban population *(% of total population)*	33	33	42
Life expectancy at birth *(years)*	70	69	69
Infant mortality *(per 1,000 live births)*	32	37	36
Child malnutrition *(% of children under 5)*	16	20	17
Access to safe water *(% of population)*	90	77	78
Illiteracy *(% of population age 15+)*	19	16	16
Gross primary enrollment *(% of school-age population)*	120	118	114
Male	121	120	116
Female	120	119	114



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

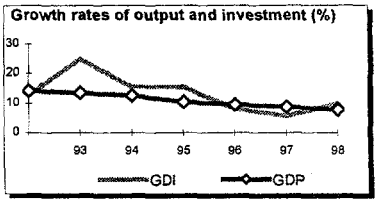
	1977	1987	1997	1998
GDP *(US$ billions)*	172.3	268.2	902.0	956.1
Gross domestic investment/GDP	28.5	36.1	38.2	39.0
Exports of goods and services/GDP	4.8	13.6	23.0	21.7
Gross domestic savings/GDP	29.0	36.2	42.7	43.6
Gross national savings/GDP	29.0	36.2	39.4	41.7
Current account balance/GDP	0.3	0.1	2.9	2.7
Interest payments/GDP	..	0.4	0.6	0.7
Total debt/GDP	..	13.2	16.3	16.7
Total debt service/exports	..	9.6	8.7	9.9
Present value of debt/GDP	..	..	14.9	..
Present value of debt/exports	..	..	63.9	..

	1977-87	1988-98	1997	1998	1999-03
(average annual growth)					
GDP	9.8	10.3	8.8	7.8	7.0
GNP per capita	8.5	8.8	7.4	6.5	6.1
Exports of goods and services	18.4	14.6	23.1	4.6	4.2

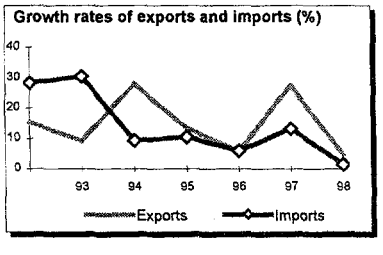


STRUCTURE of the ECONOMY

	1977	1987	1997	1998
(% of GDP)				
Agriculture	29.4	26.8	18.7	17.6
Industry	47.1	43.9	49.2	49.3
Manufacturing	31.1	34.4	37.3	37.0
Services	23.4	29.3	32.1	33.1
Private consumption	63.4	51.3	45.7	43.7
General government consumption	7.5	12.5	11.6	12.8
Imports of goods and services	4.2	13.5	18.5	17.1



	1977-87	1988-98	1997	1998
(average annual growth)				
Agriculture	6.4	4.4	3.5	3.5
Industry	10.9	14.1	10.8	8.8
Manufacturing	11.4	13.4	9.9	7.8
Services	12.7	8.6	8.3	8.5
Private consumption	9.7	8.6	6.2	5.1
General government consumption	9.0	9.9	8.2	7.8
Gross domestic investment	10.7	11.7	5.6	10.0
Imports of goods and services	19.2	12.5	12.7	1.5
Gross national product	10.0	10.0	8.5	7.5



Note: 1998 data are preliminary estimates.

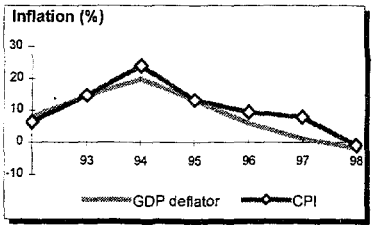
This table was produced from the Development Economics central database.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will be incomplete.

China

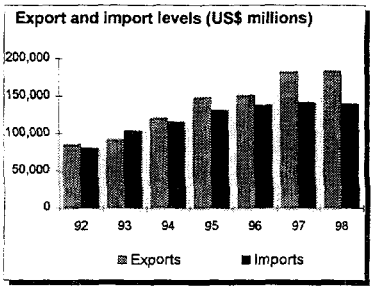
PRICES and GOVERNMENT FINANCE

	1977	1987	1997	1998
Domestic prices				
(% change)				
Consumer prices	..	7.3	7.9	-0.8
Implicit GDP deflator	1.6	5.1	1.2	-1.8
Government finance				
(% of GDP, includes current grants)				
Current revenue	..	21.5	12.0	13.1
Current budget balance	..	4.2	0.6	-2.2
Overall surplus/deficit	..	-2.1	-1.5	-4.0



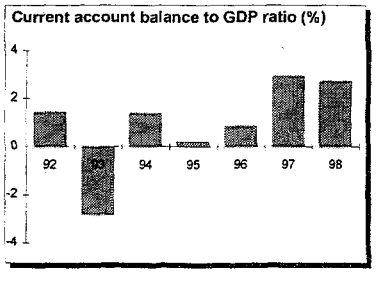
TRADE

	1977	1987	1997	1998
(US$ millions)				
Total exports (fob)	..	39,437	182,670	183,610
Food	..	4,781	11,054	9,960
Fuel	..	4,544	6,987	2,914
Manufactures	..	26,206	158,767	161,935
Total imports (cif)	..	43,216	142,361	140,226
Food	..	3,055	6,308	6,119
Fuel and energy	..	539	10,306	9,275
Capital goods	..	21,110	57,930	58,515
Export price index *(1995=100)*	..	75	95	91
Import price index *(1995=100)*	..	75	89	87
Terms of trade *(1995=100)*	..	99	107	105



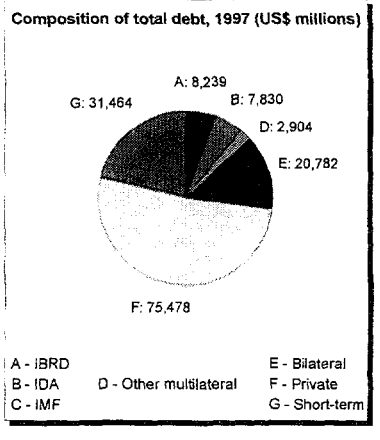
BALANCE of PAYMENTS

	1977	1987	1997	1998
(US$ millions)				
Exports of goods and services	8,550	39,120	207,253	207,140
Imports of goods and services	8,148	38,880	166,755	163,266
Resource balance	402	240	40,498	43,874
Net income	82	-164	-15,900	-19,842
Net current transfers	0	249	1,832	2,163
Current account balance	484	325	26,430	26,195
Financing items (net)	-390	4,458	9,427	-22,662
Changes in net reserves	-94	-4,783	-35,857	-3,533
Memo:				
Reserves including gold *(US$ millions)*	..	..	143,363	..
Conversion rate *(DEC, local/US$)*	1.9	4.5	8.3	8.3



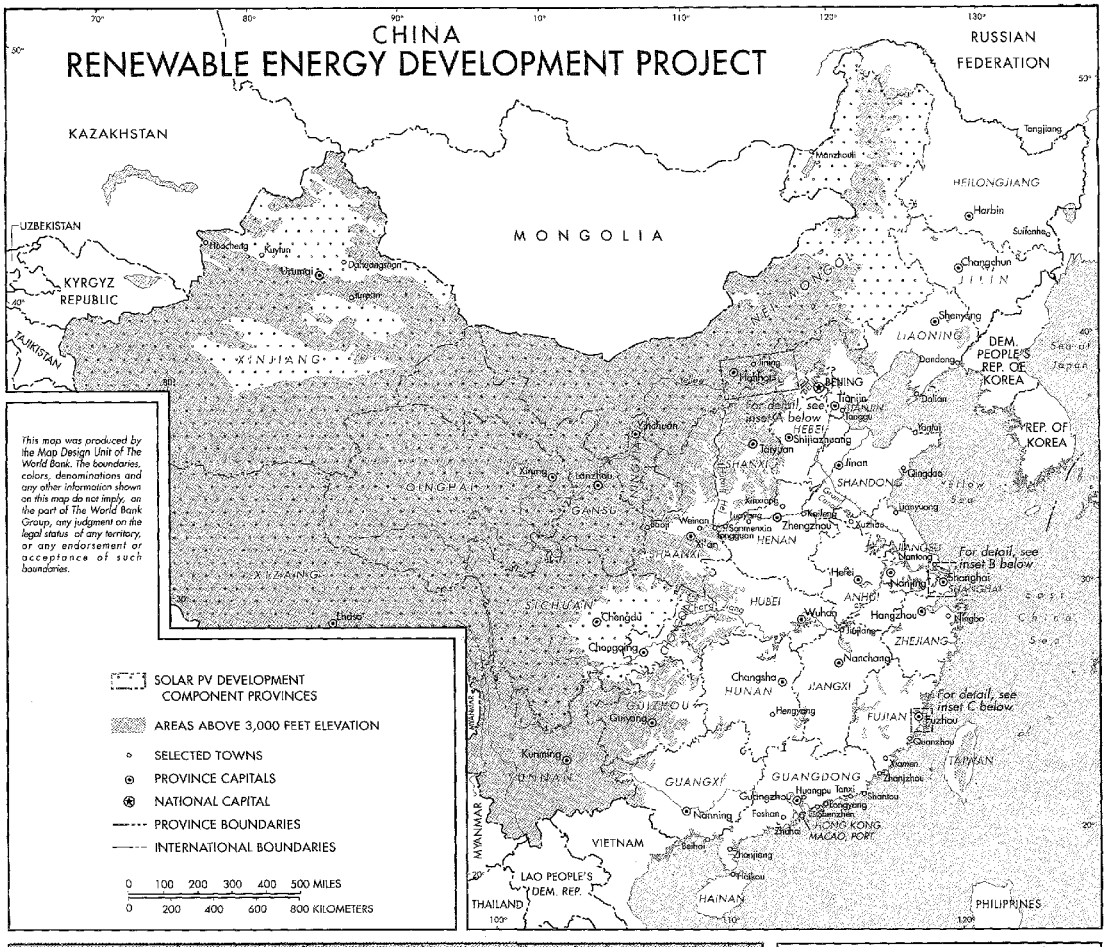
EXTERNAL DEBT and RESOURCE FLOWS

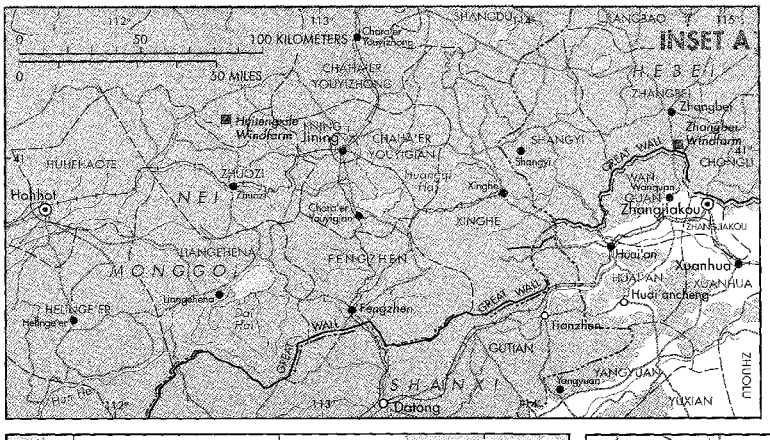
	1977	1987	1996	1997
(US$ millions)				
Total debt outstanding and disbursed	..	35,340	128,817	146,697
IBRD	..	1,427	7,616	8,239
IDA	..	1,330	7,579	7,830
Total debt service	..	3,852	15,756	18,445
IBRD	..	208	840	858
IDA	..	12	73	81
Composition of net resource flows				
Official grants	..	209	249	228
Official creditors	..	626	4,401	4,315
Private creditors	..	5,462	6,454	8,134
Foreign direct investment	..	2,314	40,180	44,236
Portfolio equity	..	0	3,466	8,457
World Bank program				
Commitments	..	1,306	1,900	2,425
Disbursements	..	702	2,097	2,275
Principal repayments	..	97	364	377
Net flows	..	605	1,734	1,898
Interest payments	..	124	549	562
Net transfers	..	482	1,185	1,335



Note: This table was produced from the Development Economics central database. 4/27/99

MAP SECTION


CHINA
RENEWABLE ENERGY DEVELOPMENT PROJECT
RUSSIAN FEDERATION
KAZAKHSTAN
MONGOLIA
UZBEKISTAN
KYRGYZ REPUBLIC
TAJIKISTAN
HEILONGJIANG
JILIN
LIAONING
NEI MONGOL
XINJIANG
QINGHAI
GANSU
NINGXIA
SHANXI
HEBEI
BEIJING
TIANJIN
SHANDONG
HENAN
SHAANXI
SICHUAN
HUBEI
ANHUI
JIANGSU
ZHEJIANG
JIANGXI
HUNAN
GUIZHOU
YUNNAN
FUJIAN
GUANGDONG
GUANGXI
TAIWAN
HONG KONG
MACAO, PORT
HAINAN
VIETNAM
LAO PEOPLE'S DEM. REP.
THAILAND
MYANMAR
DEM. PEOPLE'S REP. OF KOREA
REP. OF KOREA
PHILIPPINES
Sea of Japan
East China Sea
Yellow Sea
For detail, see inset A below
For detail, see inset B below
For detail, see inset C below
This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
SOLAR PV DEVELOPMENT COMPONENT PROVINCES
AREAS ABOVE 3,000 FEET ELEVATION
SELECTED TOWNS
PROVINCE CAPITALS
NATIONAL CAPITAL
PROVINCE BOUNDARIES
INTERNATIONAL BOUNDARIES
0 100 200 300 400 500 MILES
0 200 400 600 800 KILOMETERS


INSET A
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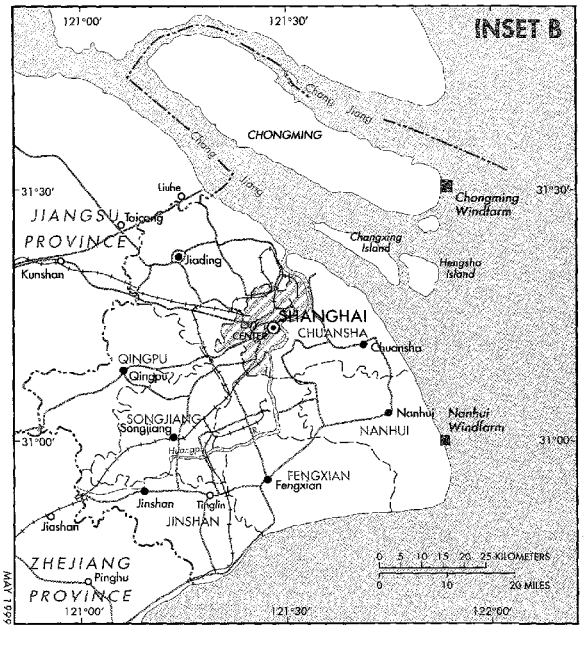
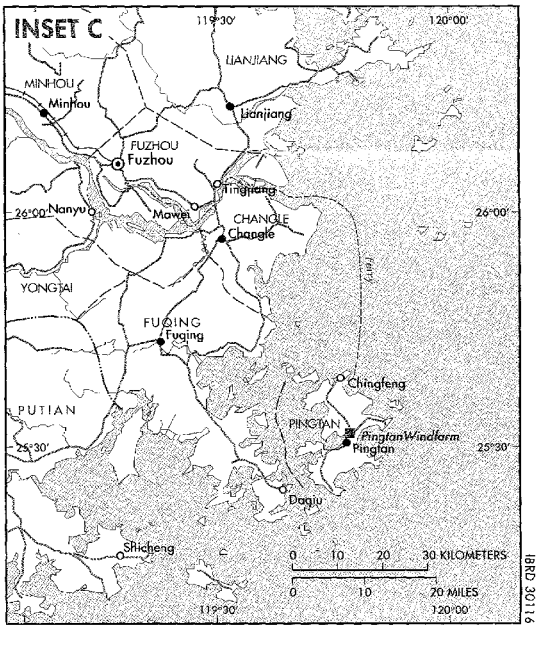
0 30 MILES
SHANGDU
LIANGBAO
CHAHAR YOUYIZHONG
CHA'ER YOUQIAN
CHA'ER YOUYIGIAN
HUHEHAOTE
ZHUOZI
NEI MONGOL
JIANGEHENA
FENGZHEN
HELINGE'ER
HEBEI
ZHANGBEI
SHANGYI
GREAT WALL
XINGHE
QUANKOU
ZHANGJIAKOU
HUAI'AN
XUANHUA
HUAIANCHENG
TIANZHEN
GUTIAN
SHANXI
DATONG
YANGYUAN
ZHUOLU
YUXIAN
Hohhot
Huitengxile Windfarm
Jining
Zhangbei Windfarm
Zhangjiakou
Xuanhua
Huai'ancheng
Fengzhen
Tianzhen
Datong
WINDFARM SITES
AREAS ABOVE 3,000 FEET ELEVATION
MAIN ROADS
RAILROADS
RIVERS
SELECTED CITIES
COUNTY CAPITALS
PROVINCE CAPITALS
COUNTY BOUNDARIES
PREFECTURE BOUNDARIES
PROVINCE BOUNDARIES


INSET B
121°00'
121°30'
31°30'
31°00'
CHONGMING
Chongming Windfarm
Changxing Island
Hengsha Island
JIANGSU PROVINCE
Taicang
Liuhe
Jiading
Kunshan
SHANGHAI
CHUANSHA
Chuansha
QINGPU
Qingpu
SONGJIANG
Songjiang
NANHUI
Nanhui Windfarm
FENGXIAN
Fengxian
JINSHAN
Jinshan
Tinglin
Jiashan
ZHEJIANG PROVINCE
Pinghu
0 5 10 15 20 25 KILOMETERS
0 10 20 MILES
MAY 1999


INSET C
119°30'
120°00'
26°00'
25°30'
LIANJIANG
MINHOU
Minhou
Lianjiang
FUZHOU
Fuzhou
Tingjiang
Nanyu
Mawei
CHANGLE
Changle
YONGTAI
FUQING
Fuqing
Chingfeng
PUTIAN
PINGTAN
Pingtan
PingtanWindfarm
Daqiu
Shicheng
0 10 20 30 KILOMETERS
0 10 20 MILES
IBRD 30116