Document of

THE WORLD BANK

Report No: 37153-MN

PROJECT DOCUMENT

ON A

PROPOSED IDA GRANT

IN THE AMOUNT OF USD 3.5 MILLION EQUIVALENT

AND

PROPOSED GRANT FROM THE

GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF USD 3.5 MILLION

TO

MONGOLIA

FOR A

RENEWABLE ENERGY AND RURAL ELECTRICITY ACCESS PROJECT

November 15, 2006

Energy Sector Unit
Infrastructure Department
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective October 31, 2006)

Currency Unit	=	MNT
MNT 1,165	=	US$1
US$1.478	=	SDR 1

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CAS	Country Assistance Strategy
CDD	Community-driven Development
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
COE	Cost of Electricity
ESMAP	Energy Sector Management Assistance Program
EIA	Environmental Impact Assessment
GEF	Global Environment Facility
GHG	Green House Gas
GNP	Gross National Income
GOM	Government of Mongolia
GON	Government of Netherlands
ICT	Information and Communication Technologies
IDA	International Development Association
MOFE	Ministry of Fuel and Energy
M&E	Monitoring and Evaluation
NGO	Non-government Organization
NREC	National Renewable Energy Center
OOPP	Objective Oriented Project Planning
PIU	Project Implementation Unit
PV	Photovoltaic
RET	Renewable Energy Technology
SHS	Solar Home System
SLP	Sustainable Livelihood Project
SSC	Sales and Service Center
WTS	Wind Turbine System
TA	Technical Assistance
UNFCCC	United Nations Framework Convention on Climate Change

Vice President:	James W. Adams
Country Manager/Director:	David Dollar
Sector Manager:	Junhui Wu
Task Team Leader:	Arturo S. Rivera

MONGOLIA

RENEWABLE ENERGY AND RURAL ELECTRICITY ACCESS PROJECT

PROJECT APPRAISAL DOCUMENT

EAST ASIA AND PACIFIC

EASEG

Date: November 15, 2006	Team Leader: Arturo S. Rivera
Country Director: David Dollar	Sectors: Renewable Energy (70%);
Sector Manger/Director: Junhui Wu	Power (30%)
Project ID: P099321	Themes: Rural services and infrastructure (P);
Lending Instrument: Grant	Environmental screening category: C
	Safeguard screening category: S3

Global Supplemental ID: P084766	Team Leader: Arturo S. Rivera
Lending Instrument: Grant	Sectors: Renewable Energy (100%)
Focal Area: Climate Change	Themes: Climate Change (P)
Supplement Fully Blended?: Yes	

Project Financing Data

[ ] Loan [ ] Credit [X] Grant [ ] Guarantee [ ] Other:

For Loans/Credits/Others:
Total Bank financing (US$m.): 3.5
Proposed terms: Standard for IDA Grant

Financing Plan (US$m)

Source	Local	Foreign	Total
RECIPIENT	10.00		10.00
GLOBAL ENVIRONMENT FACILITY		3.50	3.50
IDA Grant		3.50	3.50
NETHERLANDS: MIN. OF FOREIGN AFFAIRS / MIN. OF DEV. COOP.		6.00	6.00
Total:	10.00	13.00	23.00

Recipient: **Government of Mongolia**

Responsible Agency: **Ministry of Fuel and Energy**

Estimated disbursements of IDA Grant (Bank FY/US$m)

FY	07	08	09	10	11				
Annual	0.10	0.80	1.00	1.00	0.60				
Cumulative	0.10	0.90	1.90	2.90	3.50				

Estimated disbursements of GEF Grant (Bank FY/US$m)									
FY	07	08	09	10	11				
Annual	0.20	0.60	1.00	1.00	0.70				
Cumulative	0.20	0.80	1.80	2.80	3.50				

Project implementation period: Start: January 1, 2007 End: December 31, 2011
Expected effectiveness date: March 31, 2007
Expected closing date: December 31, 2011

Does the project depart from the CAS in content or other significant respects? ***Ref. PAD A.3***	[ ]Yes [X] No
Does the project require any exceptions from Bank policies? ***Ref. PAD D.7***	[ ]Yes [X] No
Have these been approved by Bank management?	[ ]Yes [ ] No
Is approval for any policy exception sought from the Board?	[ ]Yes [ ] No
Does the project include any critical risks rated "substantial" or "high"? ***Ref. PAD C.5***	[X]Yes [ ] No
Does the project meet the Regional criteria for readiness for implementation? ***Ref. PAD D.7***	[X]Yes [ ] No

Project development objective ***Ref. PAD B.2, Technical Annex 3***
To increase access to electricity and improve reliability and affordability of electricity services among the herder population and in off-grid soum centers.

Global Environment objective ***Ref. PAD B.2, Technical Annex 3***
To remove barriers to the development and use of renewable energy technologies in off-grid and grid-connected systems and reduce emissions of carbon dioxide.

Project description *[one-sentence summary of each component]* ***Ref. PAD B.4, Technical Annex 4***

A. Herders' electricity access: establishment of rural retail and service network for private and public investments in standalone solar home systems and small wind turbine systems.
B. Off-grid soum center electricity service: soum utility service reform, local power network rehabilitation, and introduction of renewable–diesel hybrid power generation.
C. National policy development and institutional strengthening: development of policies and regulations for grid-connected and off-grid renewable energy investments, project management, monitoring and evaluation.

Which safeguard policies are triggered, if any? None. ***Ref. PAD D.6, Technical Annex 10***

Significant, non-standard conditions, if any, for: ***Ref. PAD C.6***

Board presentation: None
Grant effectiveness: The execution and delivery of the GEF Grant Agreement, the establishment of Project Steering Committee, the approval and adoption of the Project Implementation Manual, the establishment and sufficient staffing of PIU, the training of financial and procurement management staff of PIU, and the approval of the first year work program.
Covenants applicable to project implementation: See Section C.6

MONGOLIA

Renewable Energy and Rural Electricity Access Project

CONTENTS

ANNEXES

A. STRATEGIC CONTEXT AND RATIONALE

1. Country and sector issues

Mongolia has made strides in achieving macroeconomic stability and fundamental structural reforms since its transition to democracy and a market-based economy in 1990. With the assistance of international financial institutions and the wider donor community, substantial progress has been achieved over the last decade in creating a private sector-led open economy. The next development challenge is to improve the lives and welfare of its people and reduce poverty by accelerating sustained and equitable economic growth.

This challenge is particularly daunting in Mongolia's vast rural areas where about 1.1 million people live. The rural population includes primarily nomadic herders and residents of soum centers[1], which are hubs of public and commercial institutions serving the herders. One of the key ingredients of improved lives and welfare is access to modern infrastructure services, and in particular electricity service. Only about 25% of the herder households have access to electricity, compared with 80% of soum center residents, and over 90% in the urban areas where about 1.5 million people live.

There are essentially three separate markets for electricity in Mongolia. The first and largest market includes all grid-connected cities and towns and is dominated by Ulaanbaatar, the Capital city. This market accounts for some 97% of the total electricity supply and reliability averages 23 hours/day. The second market consists of mainly off-grid soum centers, where stand-alone diesel generators provide limited services. This market accounts for about 3% of the total electricity supply. The third market covers the nomadic herders, is highly decentralized, and remains largely undeveloped. Household-based power supply systems are the only option for this market. Rural electrification focuses on the second and third markets.

Of the 314 soum centers in the country, only 117 are connected to the national or regional grids. The remaining 197 soum centers depend on small diesel generators operated by soum governments. During the summer half of these off-grid soum centers do not operate their generators and others operate just a few hours in the evening. In winter months only one third of the off-grid soum centers operate diesel generators continuously. This has been caused by a combination of high operation costs, due to high fuel prices and system losses, and a lack of operational funding, due to a deficient tariff and billing system. The Government of Mongolia (GoM) plans to connect most of the off-grid soum centers with the national or regional grids in the next 10 years or so. There are about 70 off-grid soum centers which are considered uneconomical for grid connection due to their remoteness and will need financially sustainable solutions to improve the reliability and affordability of electricity services.

Most nomadic herders have no access to electricity. The main culprits include (i) high costs of household power systems coupled with low incomes of many herder households;[2] (ii) substantial

[1] Soums (equivalent of prefectures) are subdivisions of Aimags (equivalent of provinces). Soum centers are home to soum governments (lowest-ranked government administration), social and commercial institutions, such as hospitals, schools, and banks, which serve the herders.

[2] About 40% of the estimated 170,000 herder households have annual cash income below US$450.

logistic difficulties of developing the supply chain to support a decentralized market for a small and mobile customer base spread over a vast landscape[3]; and (iii) a nascent market which lacks basic quality and service standards. On the other hand, Mongolia is endowed with abundant solar and wind resources, which facilitate the adoption of solar home systems (SHSs) and small wind turbine systems (WTSs), two mature and highly portable technologies that suit the lifestyle of nomadic herders. With systems donated by the governments of China and Japan, the Government launched the "100,000 Solar Gers" program in 2001 and provided some 30,000 SHSs to herders by 2005. The program relied solely on government administrative measures. The exclusion of private sector participation left the development of herders' SHS market haphazard and did not address the critical need for services, undermining the stability and sustainability of herders' electrification.

Progress of herders' electricity access has stagnated. The reliability and service quality in many off-grid soum centers have eroded because of weakened government support. This would further worsen already limited social and health services to herders, the most vulnerable population group of Mongolia. In keeping with the Millennium Development Goals and its strategy for enhancing regional and rural development, the GoM is keen to improve access to and sustainability of electricity service for the rural population. In parallel with this objective, The GoM is eager to take advantage of the rich renewable energy resources in the country[4]. The general consensus is that rural electrification must be based on a combination of grid and off-grid solutions involving primarily renewable energy technologies (RETs). The GoM's strategies are to (a) increase electricity access for herders through SHSs and small WTSs; (b) develop renewable or renewable-diesel hybrid systems among off-grid soum centers to improve service and affordability; (c) reform soum center electricity service to make it commercially oriented; and (d) encourage private sector and community participation in provision of electricity service.

The GoM has stepped up its efforts in promoting the deployment of RETs. A draft renewable energy law was submitted to the Cabinet for review in June 2006. The National Renewable Energy Program was approved by the Parliament in June 2005, with ambitious goals for broad-based renewable energy development: increasing the share of RETs in total energy supply from 0.9% in 2005 to 3-5% by 2010 and to 20-25% by 2020.

Successful implementation of the rural electrification strategies and achievement of the goals of the National Renewable Energy Program require removal of key barriers which have impeded past efforts and will hinder the implementation of the current agenda. These barriers include:

- an institutional and regulatory vacuum in the Government, as the economy moved from a socialist to a market-based system,[5] leading to deteriorations in rural electricity services;
- lack of information and experience on best practices (for examples, technologies, business models, and subsidy systems) to improve rural electricity access and services;

[3] With 1.8 persons per square kilometer Mongolia has the lowest population density in the world.
[4] Improved energy access in Rural areas is one of five pillars in "Mongolia Sustainable Energy Sector Development Strategy Plan (2002-2010)".
[5] Up to the mid 1990s the Central Energy System (CES) provided support to rural energy systems, this was discontinued with the unbundling of the energy sector.

- limited funding from and high risk perception of consumers, government and the private sector, constraining the increase of electricity access for herders and the improvement of electricity service in soum centers.

The proposed project, through an integrated technical assistance and investment program to remove the above barriers, will provide institutional support for broad-based renewable energy development in Mongolia, and in particular, will assist GoM to implement its renewable energy-based electrification strategies for herders and off-grid soum centers. This project will be linked to the ongoing Bank-supported Energy Project, which focuses on improving energy efficiency, cash collection and reducing losses in Ulaanbaatar and targeted aimag centers, the Rural Education Project, the Sustainable Livelihoods Project (SLP), and the rural Information and Communication Technologies (ICT) Project.

2. Rationale for Bank involvement

The proposed project is consistent with the CAS core strategic objectives of: (a) consolidating the transition to a market economy by improving the regulatory and legal environment for increasing private sector participation in the provision of infrastructure services; and (b) reducing vulnerabilities by enhancing rural development and environmentally sustainable development. Improving energy infrastructure will also help to lessen Mongolia's characteristic remoteness and create new opportunities for its rural people. It is also aligned with the government's Economic Growth and Poverty Reduction Strategy and supports one of the five pillars of the government's Energy Strategy, approved in 2002, that is: improving access to energy supplies by the rural population, especially by making greater use of renewable energy resources.

The World Bank has been a major partner of GoM in the energy sector and has been actively involved in the sector's restructuring and performance improvement. Just as the Bank's presence facilitated the National Renewable Energy Conference held in October 2005, its support at the current juncture is crucial to assist GoM in rationalizing public investments in rural electrification and in bringing new partnerships. It would facilitate the development of alternative arrangements with private suppliers of SHSs and small WTSs, as well as community participation in the improvement of electricity service at off-grid soum centers.

The proposed GEF co-financing will help develop a policy framework for broad participation of the private sector and other donors in realizing Mongolia's renewable energy market potential – especially for wind and solar PV. Considerable pre-investment work has been done by the Government and its development partners (especially the governments of Japan, the Netherlands, Germany, and Denmark). Some of these development partners have indicated contributions of significant additional funding should a platform of co-financing be firmly established with GEF and IDA participation. In particular, GEF barrier-removal financing will help (i) introduce effective mechanisms, reforms and new/revised regulations in the two rural electrification segments – soum centers and herders – to put the RETs on a sound footing for sustained, reliable market growth; and (ii) formulate regulations and guidelines for introduction of RETs to meet future growth in electricity demand in the main grids.

Further, the proposed IDA participation will complement ongoing projects aimed at reducing rural vulnerability and serve as the lead partner in rural electrification and renewable energy market development activities, building on the previous work by other development partners, including the Asian Development Bank and GTZ of Germany.

3. Higher level objectives to which the project contributes

The project contributes to the higher level objectives outlined by the Government: (i) attracting private sector participation in the energy sector; (ii) reducing urban and rural vulnerabilities; and (iii) improving the efficiency and effectiveness of the public sector.

The GEF-financed activities will support the objective of GEF climate change Operational Program 6: promoting the adoption of renewable energy by removing barriers and reducing implementation costs. The strategies that the proposed GEF financing will support are closely aligned with three of the Strategic Priorities for the Climate Change Focal Area:

- Increase access to local sources of financing for renewable energy and energy efficiency (CC-2). The project will collaborate with the World Bank's SLP, which is expanding to all soums in the country, to facilitate the inclusion of financing herders' purchase of SHSs and small WTSs in the credit/loan line of business of rural banks;
- Power sector policy frameworks supportive of renewable energy and energy efficiency (CC-3). For the herders, the policy framework will facilitate sales of SHSs and small WTSs by private traders with supporting arrangements by the government in instituting product standards and warrantees. For the soum systems, the policy framework will enable the introduction of renewable energy supply sources and private operators. The latter will be supported by introducing changed business management practices, inclusive of rehabilitation of existing networks, loss reduction, improved operational practices, tariff reform and consumer energy efficiency; and
- Productive uses of renewable energy (CC-4). Synergy will be sought with other rural development projects, including the SLP and the ICT project, to expand the opportunities for productive use of electricity at soum centers supplied by renewable or renewable-diesel hybrid systems.

B. PROJECT DESCRIPTION

1. Lending instrument

The proposed project will be financed by a Technical Assistance Grant provided under IDA 14, a GEF grant contribution, a grant support of the Government of Netherlands, and budgetary and in-kind supports of GoM. The project will be implemented over a period of five years.

2. Project Development Objective and Key Indicators

The development objective of the proposed project is to increase access to electricity and improve reliability and affordability of electricity service among the herder population and in off-grid soum centers. This objective will be achieved by (i) assisting the development of institutions and delivery mechanisms based on public-private-sector partnership and community

participation for rural electrification; (ii) facilitating herders' investments in SHSs and small WTSs; and (iii) rehabilitating mini grids in selected off-grid soum centers, improving their operations and management practices, followed by introduction of renewable or renewable-diesel hybrid generation systems. The project also will help strengthen the institutional and regulatory capacity at national level to develop grid-connected and off-grid renewable energy supplies.

The project's overall development outcome will be a more effective, efficient and sustainable framework and delivery system for the provision of electricity service in rural areas, involving public-private partnerships. For the nomadic herders, the framework will include the ready availability of more reliable and convenient lighting systems and greatly improved information facilities by being able to use radios and TVs. For the soum centers, the outcomes will be better, more reliable and affordable and longer hours of electricity supply, increasing performance and operating hours in public and private institutions, such as schools, rural health centers, ICT centers, shops, and other business entities. Thus the public and private institutions in the soums will be able to provide a better level of service to the soum population, as well as to the herders who visit the soums for their essential needs and for temporary stays during the winter season.

The key development indicators include: (i) percent of herder population with access to reliable electricity services provided by SHSs and small WTSs; and (ii) number of people in off-grid soum centers with improved reliability and affordability of electricity services supported by renewable or renewable-diesel hybrid systems. These will be monitored on an annual basis and aggregated at the completion of the project implementation.

3. Project Global Environment Objective and Key Indicators

The global environment objective is to remove barriers to the development and use of renewable energy technologies in grid and off-grid connected systems and reduce emissions of carbon dioxide. The rehabilitation of the soum mini grid will further reduce diesel fuel consumption of the hybrid systems with additional CO_2 emissions reduction benefits.

The key indicator will be avoided CO_2 emissions resulting directly from the proposed project. This will be assessed at the completion of the project implementation based on SHSs and small WTSs sold, contribution of hybrid systems, and reduced system losses in soum grids.

4. Project Components

The proposed project has three components: (i) Herders' electricity access; (ii) Soum center electricity service; and (iii) Institutional capacity building**.** The beneficiaries are rural households, commercial enterprises, and public institutions, as well as national and local governments.

Component A: Herders' Electricity Access (US$11.6 million total estimated cost: $0.9 million GEF, $4 million Dutch Government, and $6.7 million GoM). This component will develop and enhance a rural retail and service network for SHSs and small WTSs and will facilitate the

acquisition of at least 50,000 systems by herders over 5 years (with an estimated $10 million leveraged investment by herders). These objectives will be achieved through:

- Technical assistance in (i) sales and service network development – helping certified private dealers set up and expand a retail/service network of aimag and/or soum-based Sales and Service Centers (SSCs). A battery replacement management program will be designed and implemented as well. (ii) equipment quality control – introduction of product quality standards, compliance and warrantee requirements; (iii) marketing and sales/service supports – business and technical trainings for dealers and their SSCs, information campaigns and publication of catalogs of certified equipment, rolling out a smart subsidy program, and social consultation and outreach to herders.
- Investment co-financing (smart subsidies) to buy-down the acquisition cost of solar or wind electricity systems for herders and at the same time provide an incentive for sales of certified equipment by private dealers. Pro-poor flat subsidies (smaller systems effectively get higher subsidies) will be adopted.

Component B: Soum Center Electricity Service (US$10.09 million total cost: $2 million GEF, $3.29 million IDA, $2 million Dutch Government, and $2.8 million GoM). This component will develop the institutional and technical capacity for off-grid soum center electricity services and invest in mini grid rehabilitation and renewable or renewable-diesel hybrid systems:

- Technical assistance in (i) development of a policy and regulatory framework for soum electricity service, including cost-reflective tariff and billing system, assets and operational management involving the private sector; (ii) establishment of soum electricity users associations and soum electric utilities; (iii) technical and feasibility studies for the configuration and construction of small renewable or renewable-diesel hybrid systems and soum electric grids rehabilitation; and (iv) cross-sector assistance to soum-level public institutions on energy management.
- Investments in (i) rehabilitation of mini grids in about 30 off-grid soum centers where users association and soum utility are established; and (ii) conversion of the existing diesel generation units to renewable or renewable-diesel hybrid systems based on specific site conditions and in about 20 off-grid soums where mini grids are rehabilitated.

Component C: Institutional Capacity Building (US$1.31 million total cost: $0.6 million GEF, $0.21 million IDA, and $0.5 million GoM). This component will strengthen national renewable energy policy development and support project implementation by:

- Assistance in development of a regulatory framework and/or associated subsidiary legislation for grid-connected renewable energy systems;
- Project management, monitoring and evaluation, and assistance in the institutional development of the National Renewable Energy Center (NREC) through training, business planning and work program development in view of its responsibilities in the implementation of the national renewable energy agenda.

This is a fully blended project. GEF, IDA, and GoM will co-finance technical assistance activities which are designed to remove barriers to expanding herders' electricity access, efficient delivery of electricity service in off-grid soum centers through renewable or renewable-diesel hybrid systems, as well as broad-based renewable energy development. GEF financing

will also support demonstration of technical models for small hybrid systems in the extreme climate conditions of Mongolia. Detailed financing arrangements are described in Annex 5.

5. Lessons learned and reflected in the project design

The proposed project takes into account the Bank's experiences in rural electrification, especially of those related to promoting the adoption of renewable energy technologies.[6] The project design also reflects lessons from projects and studies in China, Bangladesh, India, Philippines, Senegal, Sri Lanka, Vietnam, Zimbabwe, and etc. Key lessons from these operations reflected in the design of the proposed project include:

- To ensure institutional and financial sustainability, rural energy programs must maximize private sector (small and medium enterprises-SMEs) participation, as well as supporting inputs and services from social service institutions;
- To promote project ownership and market development, the Bank needs to support stakeholder and community participation, and demonstrate that this can lead to flexibility in project design and implementation;
- Targeted subsidies and reliable credit services are needed to make RET systems affordable to rural households;
- To develop viable rural energy SMEs, it is critical to provide early hand-holding in business development combined with modest amounts of start-up financing. This is particularly true in Mongolia where the total market for such activities is very limited and more than initial hand-holding may be required;
- To achieve desired impacts on living standards, it is critical to take an integrated approach that links rural electricity services with rural development, livelihood support and income generating activities;
- Rural electrification programs should be an integral part of energy sector policy. The most critical role for governments is to put in place a sound regulatory framework, an adequate tariff structure, and a dedicated rural electrification agency that can look after mobilization of concessionary financing;
- From the ongoing heating stoves project and rural banks, the crucial importance of easily accessible local points where (or from whom) buyers can acquire information, instructions, sample items and assistance for purchase and installation of needed equipment.

An overall lesson learned from project experience shows that partnerships and community involvement are critical, since private sector alone cannot lead to improved energy access. This is particularly true in the case of Mongolia, where private dealers are just developing; the market is costly to serve and is small in size and, further, Government previous intervention may have crowded out this incipient market. The project seeks to strike a balance to enable a more sustainable market.

[6] Main references include: (i) *New Renewable Energy: A Desk Review of the World Bank's Assistance*, prepared by the IEG of the World Bank, July 10, 2006; (ii) *A Review of the ESMAP Rural Energy and Renewable Energy Portfolio*, Joint UNDP/ESMAP Publication, April 2004; and (iii) *Best Practice Manual: Promoting Decentralized Electrification Investment*, Joint UNDP/ESMAP Publication, 248/01, 2001

6. Alternatives considered and reasons for rejection

The institutional development and sector reform activities in the project reflect the priority activities identified in the rural electrification strategy in Mongolia. These comprise of the following categories: (a) Aimag center electrification (expansion, efficiency improvements); (b) Soum center electrification, including connection to regional or national grid where economical and development of renewable energy alternatives; and (c) individual household systems, focusing primarily on SHSs and small WTSs.

Alternatives considered included:

- Implementation of a cross-sector infrastructure project. This option was considered in the earlier stages of concept discussion, for example, incorporating provision of infrastructure services such as water, electricity, ICT in rural areas. Given Mongolia's limited implementation capacity, it was decided to: (i) keep projects simple in terms of design and implementation; and (ii) to target interventions in a sequenced fashion.
- Financing of rural electrification projects by Government funds alone and ad-hoc donor interventions. This alternative was rejected due to the substantial needs in institutional capacity building, which are best dealt within a multi-year Bank project.
- Full integration of an energy component into another rural development project. This option was considered in view of the high demand of energy related projects in the ongoing Sustainable Livestock Project, which focused on the provision of infrastructure services among others to rural communities. This option was rejected due to different time schedule of both operations and implementation risks.
- The alternative of proceeding without the GEF-supported technical assistance to organizational development, institutional strengthening, capacity building, and framework creation was considered. This alternative would result in overall much slower progress towards reaching the goal of providing access to electricity in rural Mongolia. Without GEF support for improving the physical planning process, developing alternative delivery arrangements, fine-tuning the regulatory framework, the long-term sustainability of the Mongolia rural electrification effort would be seriously hampered.

C. IMPLEMENTATION

1. Partnership arrangements

The preparation of the project has involved extensive consultation with concerned government agencies, donors, local banks, local RET dealers and other stakeholders in identifying the main issues affecting energy access in rural areas. A Mongolian delegation visited China to learn from experience in RET market development under similar conditions in Inner Mongolia; an objective-oriented project planning (OOPP) workshop took place in August 18-19, 2005, and an international conference attended by local banks, international donors, practitioners and suppliers from other countries took place in Ulaanbaatar during October 5-7, 2005.

The project will be implemented with contributions from four project partners, including GEF, IDA, the Government of Netherlands, and the Government of Mongolia. The project will coordinate with ongoing efforts by GTZ in provision of renewable energy systems in Uliastai

region. A second OOPP workshop will be organized during early project implementation, to assess preliminary results and, if needed, adjustments to ensure achievement of project objectives.

2. Institutional and implementation arrangements

The Ministry of Fuel and Energy has entrusted the National Renewable Energy Center (NREC) to implement the project. NREC will establish by project effectiveness date a Project Implementation Unit (PIU) with adequate staff to manage day-to-day activities of the project, including contracting, procurement, supervision, and monitoring and reporting. MOFE has appointed a ministry-level coordinator for the project. A steering committee comprising key staff of the Ministries of Finance, Fuel and Energy will be established. It will meet as needed but at least twice per year to review project implementation and provide guidance for the project.

The first 12-18 months of project implementation particularly important and will focus on putting in place the institutional mechanisms for both the herder and soum component. The output of this stage i.e. an operational retail network for SHSs and small WTSs, rolling out of the smart subsidy program, technical standards; preparation of bidding documents; setting up community association in Soums; establishing Soum utilities, detailed operational manual, etc will lay out the foundation for a 2nd phase of implementation and installation of the project on its two components.

The confirmed GoM's co-financing in the project is $10 million and there are possibilities of subsequent government contributions during project implementation. In order to maintain the consistency in project design and implementation a mechanism for the use of subsequent GoM contributions will be agreed with IDA during project implementation.

The Herders Electricity Access component will facilitate private-sector participation in developing the decentralized electricity market among herders and will assist in the establishment of a rural sales and service network for SHSs and small SWTs. The implementation will take place in two phases. During the initial phase (1-2 years) the working mechanism of a retail network consisting of certified private dealers and their aimag and/or soum Sales and Service Centers will be put in place and piloted: equipment quality standards and warrantee requirements will be introduced, marketing and information campaigns will be carried out, certified equipment will be sold, the smart subsidy scheme will be implemented, and local banks will be involved in related financial services to herders and dealers, such as payments and consumer loans/credits. Most systems sold during the initial phase will be procured through one international competitive bidding (ICB) tender. The ICB-procured systems will be pre-financed by an ear-marked subsidy budget of $6.7 million from GoM. During the second phase the retail network will be improved to serve the herders more efficiently. All equipment and system sold during the second phase will be procured directly by certified dealers based on their own retail needs. A regularly updated catalog of certified equipment and systems will be used to help herders' purchase decisions.

The Soum Center Electricity Service component will require a systematic community development effort, whereby soum end-users associations are created and soum electricity

services are transformed into a commercially oriented business (soum utility) run by private entities. Contractual arrangements will be developed (flexible and tailor-made for each soum), between soum government (current asset owner) and the soum utility. Ownership of the generation plant and the distribution system will remain with the soum government while alternative arrangements will be studied and proposed during project implementation. Energy efficiency of the local network and of end-user appliances will be promoted. The development of renewable or renewable-diesel hybrid electricity systems and selection of off-grid soum centers will be evaluated by PIU according to criteria set by the project. These arrangements will be piloted in 2-4 off-grid soum centers and will be improved and expanded to 14-16 additional off-grid soum centers.

The Institutional Capacity Building component will be implemented by NREC in consultation with other concerned government agencies, NGOs and private sector stakeholders.

3. Monitoring and evaluation of outcomes/results

The project will develop a monitoring and evaluation (M&E) framework and assess economic and social benefits. To assess benefits and impact of rural electrification project, the proposed project will rely on household survey data and use methodology developed by ESMAP, documented in a study entitled, "Rural Electrification and Development in the Philippines: Measuring the Social and Economic Benefits." Parallel to benefit assessment, the project will develop an M&E framework focusing on the delivery mechanism of Herder's Electrification.

The data for the project's results indicators will come from project implementation reports prepared by NREC. Trainings will be provided to NREC to effectively conduct the M&E work of the project, starting in the fall of 2006.

Social consultations with main beneficiaries (herders and soum center residents) will be conducted to assess the impact and effectiveness of the proposed project. The development of renewable or renewable-diesel hybrid electricity systems will be evaluated by the PIU assisted by consultants. The mid-term review of the project will be conducted 18-24 months from the project launch so as to more effectively assist the achievement of project objectives.

4. Sustainability and Replicability

Sustainability: The sustainability of the proposed project is supported by strong government commitments in promoting renewable energy and rural developments. The project will develop an institutional framework that provides maximum support for private-sector participation, as well as for active engagements of other stakeholders and social institutions.

For the off-grid soum centers, the introduction of soum users associations and their involvement in the restructuring of the soum electricity service is expected to greatly enhance beneficiaries' ownership. More appropriate electricity tariffs and consumption-based billing for all end-users will be more readily acceptable when countered with increased service levels and will contribute to generating sufficient income for soum utilities to cover operation and maintenance cost, as well as the depreciation of the equipment. Recent project preparation/reliability surveys indicate

that most, if not all, soum households can afford basic lighting service, and a large number of them actually have multiple appliances (TV sets and refrigerators, for examples) and are able to pay for additional electricity consumption.[7] Special attention will be given to the provision of electricity supply to public institutions and for productive uses. Together these elements will contribute to the development of commercially viable rural electric soum utilities.

For herders' electricity access, the sustainability is enhanced by four results: a customer that is well informed of the quality and choices of SHSs and small WTSs; a robust market that is dominated by certified equipment backed by limited warrantees; a functioning distribution and service network which can deliver and service the equipment; and a rural micro-financing system which is familiar with and well positioned to assist herders in need. Sustainability will be further enhanced by linkages to other rural development and poverty reduction initiatives of the government, including noticeably, the program to improve rural information flow and communications and other community-driven developments. For the poorest herder households, continued subsidy support for connections beyond this project period will still be needed.

Replicability: About 30% of the isolated soum centers and 40% of the available herders' market will be addressed in this project. There are essentially no renewable energy resources constraints to the development of renewable or renewable-diesel hybrid systems in rural Mongolia, as solar energy in general is abundant and wind energy potential is larger in the south than in the north. As part of its long-term renewable energy development program, the GoM plans to equip all isolated soum centers with renewable or renewable-diesel hybrid systems with or without donor co-financing and has already committed US$2.8 million in the project. The technical and business models developed with GEF assistance in the soum center electricity service component will lead the way and set the example for future investments in soum hybrid electricity systems, as well as for their sustainable operation. The approach to develop hybrid electricity systems in soum centers where community development is more advanced for organizing users associations and soum utilities will enhance the replicability by shortening the learning curve. The market for SHSs and small WTSs in Mongolia is limited by the size of the herder population, which currently includes around 170,000 households. Market expansion and replication (new connections) beyond the project are likely to require continued subsidies for the poor, which GoM has pledged to support.

5. Critical risks and possible controversial aspects

There are three key risks which may affect the results and outcomes of the project. First, the Government and/or bilateral donors may not fully commit to the basic tenet of the project – to foster public-private sector partnerships in delivering rural electricity service both in off-grid soum centers and among nomadic herder. In the past, Government and donors have grant-financed consolidated procurement and distribution of energy equipment (diesel generators and solar PV systems) without involving the private sector, a practice that has failed to support development of local supply-chain businesses, and created unpredictable ongoing demands on the central/local Government for operating expenditures. This risk will be mitigated by reaching

[7] On average, about two thirds of the soum center households are families of employees of public institutions, and most of the rest are foster-care households for herders' children who attend schools at soum centers.

advance agreement with the Government on a policy framework for private sector participation in rural electrification and will be monitored periodically.[8]

Second, limited absorptive capacity (a weak private sector in RET retail and services and a large number of low-income herder households) and unfavorable market geography (small number of customers spread over a vast landscape) may hamper the development of a robust sales and service network for SHSs and small WTSs for herders. This risk will be mitigated by taking advantage of existing rural networks of social and commercial services (for example, soum veterinarians are trusted by and have regular contacts with herders), by targeted technical assistance to increase private sector capacity in sales and services and through subsidy provisions to buy down the cost of electrification for poor households. The risk will also be mitigated by fostering strong collaborations between this project and the ongoing Bank/GEF Renewable Energy and Development Project (REDP) in China, under which a large number of SHSs have been sold, and local supply chains strengthened, in environments similar to Mongolia.

Third, the scaling-up for renewable or renewable-diesel hybrid systems may be limited by the lack of sufficient technical and commercial experience in design and operation of such systems. Empirical experience with commercially operated hybrid systems in the particular size class envisaged for the soum centers (50 to 200 kW) is only about five years long and limited to about 50 systems world-wide. This risk will be mitigated by strengthening national design capacity, expanding operational and maintenance experiences, and developing a formal procedure for pre-feasibility and feasibility studies and optimizing designs.

Risks	Risk Mitigation Measures	Risk Rating with Mitigation
Traditional approach of government/donors may disrupt the development of a retail market for SHSs and small WTSs	Advance agreement with the government on a policy framework for tariffs and subsidies, and private sector participation in rural electrification.	S
Weak local absorptive capacity and unfavorable market geography may hamper the formation of a critical market base	Tapping into existing rural networks of social and commercial services. Provision of subsidies for the poor. Strengthening linkage to other rural development programs. Close collaboration with Bank's REDP team in China.	S
Limited experience with the particular size-class of the hybrid systems targeted by the project	Development of a formal procedure for pre-feasibility and feasibility studies, site ranking, and development of good design and implementation practices through demonstration	M
Overall Risk Rating		S

S=Substantial, M=Moderate

6. Grant conditions and covenants

Effectiveness conditions: The execution and delivery of the GEF Grant Agreement; the establishment of Project Steering Committee; the approval and adoption of the Project Implementation Manual; the establishment and sufficient staffing of PIU; the training of

[8] At the negotiations the Mongolian and World Bank delegations agreed that REAP will be carried out in accordance with the principles set forth by H.E. Mr. B. Erdenebat, Minister of Fuel and Energy in his letters dated July 18 and October 17, 2006.

financial and procurement management staff of PIU; and the approval of the first year work program.

Agreements reached with MOFE during negotiations: Refer to Annex 12.

D. APPRAISAL SUMMARY

1. Economic and financial analyses

Cost-effectiveness of Alternative Lighting Options for Herders. Three alternative lighting sources were evaluated. The estimated costs per thousand lumen hours (klh) of candles, kerosene lamps and a 20Wp SHS with two 8W compact fluorescent lamps (CFLs) are $7.53, $0.47 and $0.04, respectively. There is a clear cost-effectiveness advantage for using a 20Wp SHS for lighting based on cost per equivalent light output, compared to candles and kerosene lamps. On the other hand, a 20Wp SHS, at a cost of about $160,[9] is hardly affordable for poor herder households. About 40% of the herder households have annual cash income below $450 and will need subsidies to buy down connection costs.

Cost-effectiveness of Soum Center Electricity Supply Options: Alternative electricity supply options for remote off-grid soum centers were analyzed based on a case study of a medium-sized soum center where both wind and solar energy resources are ranked as good to excellent. The analysis, taking into consideration of full investment, operation and maintenance costs, indicated that, to meet the same demand under a 24-hour electricity supply regime, assuming 12% real discount rate and a 20-year project life, the least cost option would be a wind-diesel hybrid system, which has a levelized cost of electricity (COE) at about US$0.39/kWh. The PV-diesel hybrid system option would be most expensive, at about $0.80/kWh. The diesel-only power supply option ranked second at about $0.48/kWh.

Financial Analysis of Investments in Wind-diesel Hybrid Systems: Two business scenarios of the soum center hybrid system were analyzed. Under the partial cost recovery scenario, the initial capital investment is financed by grants (as is the case of the project), electricity sales need to pay for expenditures on operation and maintenance, as well as future investments in equipment replacement. To obtain a financial rate of return of 12%, the required level of average electricity tariff will be $0.17/kWh (for an annual sales of 198,600 kWh). In comparison, the soum center currently needs to charge $0.48/kWh just to recover the fuel cost (for an annual consumption of about 46,800 kWh) of the diesel units. At $0.17/kWh, the poorest households (annual household income < $600) in the soum center would spend about 5% of their income on basic lighting service. Under the full cost recovery scenario, electricity sales need to recover initial capital investment, pay for expenditures on operation and maintenance as well as future investments in equipment replacement. To obtain a financial rate of return of 12%, the required level of average electricity tariff will be $0.49/kWh (for an annual sales of 198,600 kWh), assuming that all investments are financed by equity (the government as the equity holder). In conclusion, with grant financing of the initial capital investment, the effective subsidy to this off-grid soum center provided through the project would be $0.32/kWh. The resulting tariff of

[9] Cost varies depending on quality of system components. A complete 20Wp SHS typically includes a 20Wp crystalline silicon PV module, a charge controller, a sealed lead-acid battery, two 8W CFLs and necessary wiring.

$0.17/kWh in this case will be affordable and can sustain the operation and maintenance of the wind-diesel hybrid system over its life, as well as finance its replacement cost.

2. Technical

Investments under the project will employ the following technologies: (i) small PV and wind turbine systems for herder households with system size varying from 20Wp to 100Wp approximately; (ii) moderate size (typically 50-200 kW) wind and PV with associated equipment for soum center hybrid systems; (iii) improvements to electricity distribution systems (for examples: poles, conductors, transformers, switchgear, meters) in soum centers; and (iv) higher-efficiency lighting and other electrical appliances.

Both PV and wind based individual home systems are being used in Mongolia both through private purchases and the government sponsored Solar Ger program. The project will introduce technical standards which need to be adhered to by participating private dealers, as well as consumer education so as to ensure both the quality of the equipment and their proper usage.

With respect to the hybrid systems in soum centers, the project will install appropriate renewable energy generators and associated equipment such as battery banks to be combined with the existing diesel generators. While wind turbines (50 to 200kW) are expected to constitute the majority of the renewable energy generation, there will also be instances of centralized solar PV systems where these are considered to be optimum for the particular location. These projects will be designed to generate approximately 40 to 70% of the energy requirements, thus allowing the networks to be operated for longer hours, particularly in the day time. Technical issues to be addressed will constitute of selection of the appropriate renewable energy resource, optimizing the capacity of the generators and associated battery system etc, rehabilitating the distribution network to provide an appropriate level of service, addressing demand management issues such as metering consumers, load limiters, propagating the use of high efficiency lamps, and other consumer appliances (particularly those associated with productive purposes).

3. Fiduciary

The financial management assessment concluded that the project meets the minimum Bank financial management requirements, as stipulated in BP/OP 10.02. The project will have in place an adequate project financial management system that can provide, with a reasonable assurance, accurate and timely information on the project status in a reporting format agreed with the project as required by the Bank. The overall financial management risk-rating of this project is substantial due to the substantial risks at the country-level and in managing fund flow and project accounts. These risks are mitigated by the establishment of a PIU with qualified financial staff, preparation, by the adoption of a sound financial management manual and by requiring a Ministry of Finance approval for withdrawal applications.

All procurements of the project will be carried out by the PIU, although MOFE and NREC will be involved in different stages of procurement by providing relevant technical expertise. MOFE has extensive experience in implementing donor-funded projects as well as Bank projects and is familiar with carrying out procurement following the Public Procurement Law of Mongolia

(PPLM) since 2000. The PIU will recruit an experienced procurement specialist and will be trained, together with NREC and MOFE on Bank's procurement procedures and the new PPLM.

4. Social

The proposed project is expected to yield positive social impacts from increased access to electricity among herders and households and institutions in off-grid soum centers. The initial OOPP workshop had identified this as a priority for rural development. The baseline survey undertaken during the project preparation further shows that access to electricity would (i) significantly increase the quality of living through improved lighting and access to information and entertainment (through TVs); and (ii) provide an opportunity for rural households to engage in income generating activities, allow households member to have flexible working hours.

Nationwide information campaigns will be conducted to raise the awareness of the project and electricity access through SHSs and small WTS among herders. Equal access to information and the project will be ensured in regions where the first language is not Mongolian by using both local and national languages to reach local herders.

5. Environment

The environmental category of the proposed project is C. The project does not pose significant environment impacts which would trigger safeguard policies, and the overall effect will be positive with reduced emissions of air pollutants from diesel generators. The project will design and implement a battery disposal management program as part of the herders' electricity access component. Such a program should be in place by the time of mid-term review.

6. Safeguard policies

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP/GP 4.01)	[ ]	[X]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[ ]	[X]
Cultural Property (OPN 11.03, being revised as OP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[X]
Indigenous Peoples (OD 4.20, being revised as OP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP/GP 7.60)*	[ ]	[X]
Projects on International Waterways (OP/BP/GP 7.50)	[ ]	[X]

7. Policy exceptions and readiness

The project is in compliance with IDA policies and procedures. There are no policy exceptions.

* *By supporting the proposed project, the IDA does not intend to prejudice the final determination of the parties' claims on the disputed areas*

Annex 1: Country and Sector Background
MONGOLIA: Renewable Energy and Rural Electricity Access Project

Imbalanced Transitions

At about US$500/capita GNP per year, Mongolia is one of the least developed countries in Asia. Its transition from a centrally-planned to a market-based economy over the past decade or so has improved macroeconomic stability and spurred economic growth. The transition has also brought about greater disparities of incomes as well as access to, and benefits from, publicly provided services. While the urban areas in general, and the capital Ulaanbaatar in particular, have gained in prosperity, progress is lacking in rural areas where living conditions remain little changed. Equitable, broad-based poverty reduction requires attention to growth bottlenecks in the rural areas, where about one half of the population resides.

This is all the more evident in the energy sector. Much of the urban population has access to both grid electricity and pipeline heating systems. About 70 percent of the total population is electrified, most of them served by centralized networks supplying electricity and heat to the capital, some of the provincial (aimag) centers, and some of the prefecture (soum) centers. In rural areas, most people have either very poor or no access to electricity services. Without access to electricity, rural living standards are limited by low agricultural and livestock productivity and very few opportunities for non-farm employment or other value-adding economic activities.

The Economic Growth Support and Poverty Reduction Strategy (EGSPRS) of July 2003 outlined the Government of Mongolia's vision to accelerate pro-poor growth and reduce poverty. It recognizes that the herder community, comprising about 40 percent of the population, is basically not provided with energy, and only 10 percent of the herding households have small-scale electricity generators capable of producing energy for electric lamps and other minor uses.

Fragmented energy sector with distinct problems and challenges

The electricity sector is comprised of three distinct segments, each of which has distinct problems with efficiency and quality of supply, and reliability of access. Two of the three market segments – "urban" and "rural" -- have power supplied by utilities. The 'rural' segment consists of four relatively larger grids in *aimag* centers, and the far more dispersed market of *soum* centers and *bag* centers. The third segment consists of mostly semi-nomadic peoples spread over much wider areas.

(i) *Main grid*: Three grids supply nearly all of the electricity sales in Mongolia - the Central (supplying Ulaanbaatar), Eastern and Western Energy Systems. The Central System alone accounts for 96 percent of the total supplies in the country and draws supply largely from combined heat and power (CHP) plants running on coal. The Western system imports electricity from Russia and uses diesel generators for backup. The Eastern system uses a coal-fired CHP. The main problems in this market segment are inefficiencies in production, high levels of station use and distribution losses, low tariffs and weak revenue recovery, leading to excessive cross-debts – from the customers to the

distribution utilities, from those to the generation companies, and in turn to the coal companies.

Electricity Supply and Consumption in Mongolia, 2004 (in million kWh)			
Supply		**Consumption**	
Gross Generation	3,303.4	*Industry and construction*	1,458.8
Imports	170.8	*Communal housing*	567.6
Total power available	3,474.3	*Transport and communications*	98.5
Consumption	2,357.0	*Agriculture*	25.6
Station use	628.8	*Other*	206.5
Losses in distribution	480.4	*Total*	2,357.0
Exports	8.2		
Source: Mongolian Statistical Yearbook (2005)			

(ii) *Independent grids*: These are isolated (i.e., not interconnected) grids, serving four *aimag* centers and 172 *soum* centers (other *aimag* and *soum* centers are connected with the national grids because of their proximity). All of them rely on diesel generators, and have a poor record of supply reliability. Reporting on their operational performance is also weak, so it is difficult to develop a precise estimate of their production and sales; a rough estimate is that, in the aggregate, these provided about 50 million kWhs of electricity (or, equivalent to just around 1.7 percent of the electricity supplied by the Central system) in 2003. Of this, between two thirds and three fourths was provided by the four *aimag* center diesels, and the remainder (about 10-15 million kWhs) by the micro-grids in the *soum* centers.

Most of the soum center micro-grids tend to provide at most four to six hours a day of electricity, typically during the time of national television transmission, somewhat longer (because of shorter days) and a greater quantity (because of seasonal in-migration) during the winter period. Most of them have no metering of household sales at all, but it is estimated that households comprise about 80 percent of the total consumption. Revenues from the households, however, comprise much less (about one third) of the total revenues, indicating that the non-household customers – mostly rural public institutions (which are often metered) – cross-subsidize the households.[10] Precise data are not available, but it appears that direct budgetary subsidies from the central government are limited – covering about one fourth of the cash costs.

The power source for the soum center grids is small diesel generators of relatively recent vintage (100 percent grant financed by Japan). They are owned and operated by local governments. Fuel costs tended to account for over 80 percent of the operating expenses;

[10] Unlike villages in some other parts of the world, Mongolia soum centers often have significant presence of public institutions – schools, hospitals, veterinary facilities, defense installations and administrative posts. These institutions often pay a higher unit price for electricity than the surrounding households, and also value supply reliability more than the household customers.

this share may even have gone up in recent years because of the increase in diesel prices (about 900+ Tg/liter).

The main problems in this segment are similar to those mirrored at the urban level: inefficiencies in production, high distribution losses, low tariffs and weak revenue recovery. These are compounded by the much higher unit cost of diesel generation (compared to electricity from CHPs using coal), very weak technical and management capacity, and the inability to raise and utilize external finance (most of which has gone to the urban market segment and, recently, to the isolated aimag grids.) Hence, the much more critical problem for the soum center micro-grids is very poor supply reliability due to: (a) antiquated distribution networks resulting in high losses, and (b) virtual absence of a rational tariff and subsidy program to encourage efficient use, loss reduction, proper management practices, or provide for growth.

(iii) *Herders*: The herder population, relying mostly on raising and marketing livestock and their products, generally lives in rural areas beyond the reach of the national or isolated Soum grids, though some of them do come to soum centers during the winters. These populations face even higher costs from self generation of electricity by household-size gasoline generators, or have almost no use of electricity or other modern fuels.

Rural Electricity Access and Reliability, and the Impact of Sector Reforms

Table 1 shows the status of electrification access in Mongolia, based on census data from 2000. Growth in access has been achieved mainly through new grid connections in urban areas. For a country with one of the lowest population densities in the world (around 1.8 person per km^2), electrification rates seem fairly high, with some 67 percent of the population (363,965 households out of 541,149) having grid access to electricity.

Table 1: **Total Households and Percentage Electrified**

	total	% with electricity	**house**	% with electricity	**ger**	% with electricity
UB	161,273	98%	126,043	99%	35,230	92%
aimag ctr	118,104	92%	73,797	98%	44,307	81%
village	17,021	85%	12,586	93%	4,435	63%
soum ctr	85,281	80%	36,948	86%	48,333	77%
Rural	159,470	9%	16,171	28%	143,299	7%
	541,149	67%	265,545	92%	275,604	43%
% of total in housing class	100%		49%		51%	
of which % electrified	67%		92%		43%	

Source: **NSO, Census 2000**

Electrification rates in larger 'urban' areas are high: 98 percent in the Capital and 92 percent in *aimag* centers, compared to 80 to 85 percent in villages and soum centers (Table 1). The data on soum centers mask the differences between soum centers connected to the main grids (more than 100) and those that rely on the diesel micro-grids. Household access rates are lower in the latter group and even those who have grid access have much poorer quality and reliability of service.

One of the main goals of the fiscal and power sector reforms under way since the late 1990s is the commercial viability of electricity/heat providers. The urban grids were unbundled into generation, transmission, dispatch, and distribution companies. Local aimag utilities were established without central government support. Isolated grids in off-grid soum centers were left to local governments, getting new 'free' diesel generators but otherwise left to fend for themselves in terms of operation and maintenance, and financing of operating costs. These reforms have not yielded the desired results yet. The situation at this stage is that in the urban grid, consumers have accumulated more than US$17 million in arrears. In the off-grid *soum* centers it is not possible to maintain arrears. Unlike the central grid which can pass the arrears in turn to coal companies, off-grid soum centers have to pay oil companies in cash. If the cash cost of operation goes up – as with the increase in diesel prices – there is a clear, unregulated price adjustment. If the customers collectively cannot pay, supplies are reduced further.

The only option for improving service and lowering costs to the people who live in the soum centers is to invest in network rehabilitation and generation options with lower operating costs (part-financed by capital grants), adopt rational tariff and revenue management schemes, and develop the capacity for operation and management. With that approach, grid connections can be extended to the remaining houses and gers in the soum centers. And the only option for electricity service for the 'outer rural' herding communities is self-electrification, preferably with cleaner energy resources. The following table summarizes the issues and potential solutions for the soum center micro-grids:

Nature of the Problem	Potential Solutions
Technical - High technical losses, particularly in the distribution system. - Existence of old Russian generators that are inefficient and for which it is increasingly difficult to obtain spare parts - Heavy dependence on fossil fuels - Not enough maintenance provided - Low plant factor	- Increase efficiencies throughout the system - Rehabilitate distribution system - Increase load and load factor - Look for substitute sources of electricity (hydro, wind) when economically justified, particularly wind generation. - Develop phased solutions that increase the demand until it becomes feasible to connect a demand center with the interconnected grid
Financial - High financial losses - tariffs well below operating costs - billing problems (non-payment, but also clients are not billed) - No provision for depreciation of assets – i.e. no provision for use of capital, so reliant on donors or subsidies for renovation and replacement - High operating costs, in particular diesel prices are increasing rapidly - Low revenues - Heavy dependence on subsidies	- Increase tariffs; they should begin to cover operating costs plus over time depreciation as well - Decrease commercial losses (send bills for all usage of electricity) - Reduce accounts payable (faster payment of bills, better collection rates) - Penalize non-payment (public announcements, disconnection, etc) - Agree on schedule to reduce and abolish subsidies over time (5-10 years)
Institutional - Utilities should operate more commercially	- Training, capacity building of key personnel (bookkeeping, system planning, client public relations) - Involvement of competent private partners needs to be reviewed. - Provide technical assistance to enable the utilities to operate efficiently.

Applicability of Renewable Energy Technologies (RETs) for electricity

Mongolia is richly endowed with solar and wind energy resources. Wind and PV resource assessments were prepared between 1997 and 2000. Solar insolation is reported to be about 4.5 kWh/m^2 on daily average and 1,400 kWh/m^2 on annual average bases, respectively. The Gobi desert and plain zones are estimated to have a technical potential of more than 800 billion kWh/year of wind electricity, with average usable time of between 3,500 and 4,600 hours per year.

A variety of experimental and demonstration projects and programs have been implemented by the government and donor agencies over the past 15 or so years. Quasi-commercial introduction of stand-alone RETs has already taken place. Unlike rural populations in many other small developing countries, there is relatively high awareness in Mongolia of solar PV and wind turbine systems for individual use. Markets for 'home size' solar photovoltaic (PV) and wind power systems have taken hold[11] – about 40,000 solar home systems (SHS) and 3,000 wind turbine systems have been sold, sometimes with heavy and poorly targeted government subsidies. Some public investments have been made in PV, wind or hybrid systems for institutional use (schools, hospitals). The supply chains have remained essentially city-based, and quality standards are weak, as are after-sales maintenance and service.

Among various planning studies, a Master Plan Study for Rural Power Supply by Renewable Energies was prepared (under JICA finance) in 2000. A Renewable Energy for Small Town and Rural Areas study (under ADB finance) followed in 2003/4. A Country Report on Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement (under Dutch trust fund support administered by ADB) was completed at the end of 2004.

In 2005, a draft Renewable Energy Law was prepared and the parliament approved a National Renewable Energy Programme. The Government has adopted the following goals:

- Provide power to all distant Soums and settlements that cannot economically be connected to centralized power grid system, by the introduction of renewable energy systems. The near term objectives (2010) are to electrify at least eight *Soum* centers remotely located from the centralized power grids, proven to have good wind power resources, by wind-diesel or wind-solar-diesel hybrid power stations, and electrify at least five *Soum* centers using solar and diesel hybrid powered systems.

- Develop and implement step-by-step sub-programs to provide schools, hospitals and public service institutions in remotely located *Soum* centers with renewable energy sources from the centralized energy grid system; to broaden application of solar and wind energy in water pumping, irrigation of crops fields and grasslands; promote knowledge based production in rural areas; and establish the basic conditions for future local development..

- Reach full achievement of objectives raised in the National Program titled "100,000 Solar Gers" to supply all herding households in rural areas with renewable energy sources. Off-

[11] Because some of the early adopters of PV technology were among the wealthier herders, system sizes ranged up to 100 Wp.

grid Soum and household electrification, which has only been demonstrated to date on a pilot scale, has been assigned an ambitious target of 150,000 households by 2020. This target envisages that up to 20 percent of the rural population, located in isolated areas, can be powered with indigenous energy resources, including solar, pico-hydro generator units, biomass, or wind.

Progress towards these goals has been hampered by a lack of effective policy and regulatory framework and enforcement procedures, private sector perception of high investment risks in the supply chains due to unpredictable market and regulations, and lack of finance for public investments (in RET generation capacity for soum micro grids and stand-alone systems for rural public institutions).

Barriers to improving Access and Quality

Improving the operating (i.e., technical and financial) performance of the *soum* micro-grids is the first step towards universal household coverage within the soum center areas. For the 'outer rural' herder households, strengthening the supply chains for self-generation systems – such as solar PV and/or wind, usually with batteries – is key to delivering high-quality products and services to the consumers. As in the case of grid customers, the initial beneficiaries of programs to accelerate adoption of stand-alone systems will be the higher-income households or public institutions that can pay cash or near-cash, progressively followed by others as incomes grow, costs decline, quality and reliability of vendor service improves, and markets deepen sufficiently to attract commercial bank interest in financing just like other consumer durables.

The key barriers to such reformed practices are:

- Weak rural electrification planning capacity to prepare Soum-based rural electrification projects that will deliver household access most cost-effectively;
- Absence of integrated rural development planning, with the result that income-generating electricity uses needed to make power supply economically viable are slow to develop;
- Insufficient availability of, and weak delivery mechanisms for, financing (grant or concessional debt) for rural electrification, even though there is a growing micro financing market;
- Inappropriate tariffs currently charged to rural clients (structure & level), which, coupled with their relatively low electricity consumption, means that rural electricity services do not cover costs and are a drain on the financial viability of the Soum governments;
- Lack of information about the appropriateness and quality aspects of solar home systems (and wind turbines);
- Lack of infrastructure for distribution, sales, and after-sales services of solar home systems and wind turbines; and
- Limited private sector capacity for scaling-up implementation of rural electrification, either for retail systems by private households and public institutions or soum center grid electrification. Put another way, the private sector currently sees government-run electrification initiatives as high-risk, unpredictable, and as having no incentives to expand their reach in rural areas, or achieve high standards of quality in the supply of hardware or services.

Also, because the unit cost of delivering electricity in remote, sparsely populated locations is high, it is imperative that electricity end use be correspondingly efficient compared to that in the urban concentrations. For stand-alone retail PV or wind systems, this is less of a problem because higher-efficiency DC lighting and appliances are already incorporated in system design. Such is not the case with AC grids in the *soum* centers, where the barriers to the adoption of higher-efficiency lighting and appliances, or even planning for promoting such adoption, are:

- Lack of any information about electricity consumption patterns by rate class or end use, because typically there is no metering except for large public institutional facilities and hence no rate classes among other customers.
- Lack of public or private sector capacity for program planning and implementation.
- Lack of technical expertise or awareness by end-use customers as regards energy efficiency technologies and practices.
- Low level of understanding of the benefits of energy efficiency relative to current and future electricity costs, in turn because the existing institutional and policy framework does not convey the cost signals in the form of rational pricing and subsidy signals.

Annex 2: Major Related Projects Financed by the IDA and/or other Agencies

MONGOLIA: Renewable Energy and Rural Electricity Access Project

Sector Issue	Project	Latest Supervision (PSR) Ratings (Bank-financed projects only)	
Bank-financed		Implementation Progress (IP)	Development Objective (DO)
Electricity sector reform, financial recovery and loss reduction	Energy Project	S	S
Community-driven rural development	Sustainable Livelihoods	S	S
Rural information and communications services	Information and Communications Infrastructure Development	Appraised in April 2006	
Improve efficiency and reduce emissions from individual stoves	Improved Household Stoves (GEF MSP)	S	S
Modernization of domestic hot water circuits in substations	UB Services Improvement Project I	S	S
Other development agencies			
Improve efficiency of district heating	ADB UB Heat Efficiency Project	NA	NA
Reduce heat consumption	UNDP GEF Commercialization of Super Insulated Building Technology	NA	NA

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

Annex 3: Results framework and monitoring
MONGOLIA: Renewable Energy and Rural Electricity Access Project

PDO/GEO	Outcome Indicators	Use of Results Information
Increase access to electricity and its benefits for nomadic herders Reduce costs, and increase reliability of electricity service in off-grid soum centers, utilizing renewable energy Reduce GHG emissions	% of herders served by reliable SHSs and small WTSs Number of people in off-grid soum centers with more reliable and affordable electricity generated by renewable or renewable-diesel hybrid systems. Projected GHG emission reductions	YR1- develop quality standards and compliance mechanism, initiate marketing and performance-based bonus schemes, rationalize tariff and subsidy approaches, and prepare tenders for network rehabilitation YR2 monitor sales of SHS and small wind turbines as well as progress in development of community associations, Soum utilities, and rehabilitation and hybrid pilots YR3 determine if strategies for herders and Soum centers need adjustment, and check if targets for hybrid system realistic, Assess main grid system expansion plans and appropriate integration of renewable energy YR5 feed into strategy for sustaining the programs and project evaluation..
Intermediate Results One per Component	**Results Indicators for Each Component**	**Use of Outcome Monitoring**
Component A : Herders Improved retail network Improved consumer awareness and knowledge Increased acquisition of SHSs and small WTSs by herders Establishment of and compliance with quality standards for equipment and service	**Component A :** Contractual agreements for private dealer participation developed and adopted with agreed business practice. Number of RET information centers established with demonstration systems and regularly updated product catalogs Annual sales of systems under the program Technical standards and quality control criteria adopted by NREC % of new systems operating satisfactorily after two years	**Component A :** YR1-YR5: monitor sales and evaluate customer feedbacks to determine effects of project-sponsored programs; adjustments made to achieve market development goals
Component B: Soum centers Community organizations created Improved management practices including cost accounting and sustainable financing of Soum utility operations Reduced grid losses RET-based hybrid systems built	**Component B :** Number of Soum users associations Number of Soum utilities providing systematic reporting of costs and revenues Number of Soum utilities with loss reduction measures implemented and realized improvements quantified Number of hybrid systems built	**Component B :** YR1-YR5: monitor implementation progress to determine whether measures are effective and approaches are realistic, adjustments made to achieve maximum impact

Component C: Institutional NREC, including PIU, functions effectively	**Component C:** Clear organizational and business plans adopted Project implementation meets expected schedules and results	**Component C:** YR1-YR5: monitor disbursement and deliverables to determine project management efficiency and effectiveness, adjustment made to meet expected schedules and results
Improved policy support to broad-based renewable energy development	National grid-connected renewable energy action plan completed	Broad consultation to improve applicability and gain support.

		Target Values					Data Collection and Reporting		
Outcome Indicators	**Baseline**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
% of herders served by reliable SHSs and small WTSs	15% (to be confirmed)	20%	25%	35%	45%	50%	Annual reports	Local government/private contractor reports	NREC and provincial governments
Number of people in off-grid soum centers with more reliable and affordable electricity generated by renewable or renewable-diesel hybrid systems	Negligible	--	2,000	6,800	12,800	16,000	Annual reports	Same as above	Same as above
GHG emissions reduced	0	---	1,000t	3,000t	7,000t	9,000t	Annual estimate	Progress reports	NREC
Results Indicators for Each Component									
Component A : Herders Contractual agreements for private dealer participation developed and adopted with agreed code of conduct for business practice.	--	Adopted	--	--	--	--	--	Project documents	NREC
Number of RET information centers established with demonstration systems and regularly updated product catalogs	0	5	15	20	10	--	Annual reports	Project documents	
Annual sales of systems under the program	0	5000	8,000	15,000	15,000	7,000	Quarterly reports	Dealer reports	
Technical standards and quality control criteria adopted by NREC	--	Adopted	--	--	--	--	--	Project documents	
% of new systems operating satisfactorily after two years	50% (to be confirmed)	---	--	90%	90%	90%	Annual reports	Consumer survey	
Component B : Soum centers									
Soum users association created	0	2	10	10	8	---	Annual reports	Project documents	NREC
Soum utilities providing systematic reporting of costs and revenues	0	2	12	22	30	30	Annual reports	Soum utility reports	

Soum grids rehabilitated	0	2	10	10	8	---	Annual reports	Soum utility reports	
Number of hybrid systems built	0	---	2	6	8	4	Annual reports	Soum utility reports	
Component C: Institutional Clear organizational and business plans adopted	--	--	--	--	--	--	Annual report	Project documents	NREC
Project implementation meets expected schedules and results	--	--	--	--	--	--	Annual report	Project documents	
National grid-connected renewable energy action plan completed	--	--	Draft	Final report				Project documents	

Annex 4: Detailed Project Description
MONGOLIA: Renewable Energy and Rural Electricity Access Project

The proposed project addresses the challenges of expanding herders' access to electricity and improving the quality and reliability of electricity service in off-grid rural townships (soum centers). It seeks to expand the markets for renewable energy technologies in Mongolia both in the near term (under the project) as well as medium-term (via pre-investment and capacity building work) in three key respects:

(a) Development of institutions and delivery mechanism for herders' electrification through solar home systems and small wind turbine systems and deepening the markets (progressively greater geographic and demographic spread), thus significantly increasing the saturation rate of SHSs and small WTSs among nomadic herders;
(b) Promote investments in use of RETs for enhancing electricity service quality and increasing affordability in off-grid soum centers; and
(c) Strengthening national regulatory and institutional capacities for broad-based renewable energy development, including introduction of RETs in the main grid supplies.

The overall premise is that in this manner, rural electrification in Mongolia will be scaled up through sustainable approaches which take advantages of the country's abundant renewable energy resources. This--and the implementation of a broad-based national renewable energy development agenda--will yield significant global environmental benefits in the form of greenhouse gas emission reductions.

Component A: Herders' Electricity Access (US$11.6 million total cost: $0.9 million GEF, $4 million Dutch Government, and $6.7 million GoM). This component will promote private-sector participation in market expansion for good quality SHSs and small WTSs among nomadic herders through the following activities:

- ***Technical assistance*** to develop rural retail markets for SHSs and small WTSs by

  (i) Facilitating the development of a retail/service network consisting of certified private dealers (often located in Ulaanbaatar) and Sales and Service Centers at aimag and/or soum centers. The project will sign contracts with pre-qualified national dealers who must abide the requirements for business practice under the project. The project will help dealers identify (if necessary) and train local SSCs. The SSCs are retailers located at places easily accessible by herders and responsible for taking orders, delivering equipment, giving instructions, and making simple repairs.[12] A battery management program will be designed. The estimated cost for these activities is $100,000 and will be financed by a GEF grant.

  (ii) Introducing product quality standards, compliance and warrantee requirements. The project will adopt internationally recognized equipment technical standards and warrantee/service criteria. These will then be part of the contractual agreement with participating dealers. The project will also assist in the establishment of a testing and certification laboratory as well as development of compliance monitoring and

[12] For example, SSCs operated by veterinarians.

certification procedures. The estimated cost for these activities is $200,000 and will be financed by a GEF grant.

(iii) Marketing and sales/service support. The project will organize national and local information and awareness campaigns. An equipment catalog will be developed and regularly updated and distributed to SSCs to provide herders independent information on available SHSs and small WTSs, components, spare parts and appliances, as well as information on prices and shipping and handling costs. The project will provide demonstration equipment at selected SSCs. A social consultation and outreach program will be implemented to continuously improve the effectiveness of the herders' electrification program. Multiple training workshops will be conducted during the course of the project. Grants will be made available for dealers with innovative approaches to expand and sustain the herders market. The estimated cost for these activities is $600,000 and will be financed by a GEF grant.

- ***Investment co-financing*** (smart subsidies) to buy-down the acquisition cost of solar or wind electricity systems for herders and at the same time provide an incentive for sales of certified equipment by private dealers. Subsidies will be applied to first time acquisition of complete SHS or small WTS systems only. It is proposed that for first-time buyers (herder households) of certified SHSs and small WTSs, a $80/system subsidy will be applied to 20 to 49 Wp systems and a $160/system subsidy will be applied to 50 to 100 Wp systems. The investment co-financing is funded by a GoM budget contribution of about $6,700,000 and a Dutch Government grant of $4,000,000. Details of the subsidy program are described in Annex 6.

Component B: Soum Center Electricity Service (US$10.09 million total cost: $2 million GEF, $3.29 million IDA, $2 million Dutch Government, and $2.8 million GoM). This component will develop the institutional and technical capacity for efficient delivery of affordable soum center electricity services and will invest in soum mini grid rehabilitation and small renewable or renewable-diesel hybrid systems:

- ***Technical assistance*** to develop a sustainable management framework for off-grid soum center electricity service, as well as in the design of appropriate renewable or renewable-diesel hybrid systems, including
  (i) *Development of a policy and regulatory framework for off-grid soum center electricity service (cost: $80,000, financing: $80,000 IDA), including*:

  Carrying out business planning and tariff studies and on the basis of:
  - developing a rationalized framework for tariff-setting, metering, billing, and revenue management, towards the goal of ensuring the financial sustainability of soum center electricity services by recovering operational costs as well as capital replacement costs.
  - formulating new and/or revising legislation to facilitate private participation in ownership and management of soum center electricity generation and distribution facilities; and
  - preparing relevant contracts.

(ii) *Soum level capacity building (cost: $360,000, financing: $200,000 GEF and $160,000 IDA).*

Creation of soum center electricity users' association and soum center utilities to enhance community involvement and improve financial and operational management. A detailed business plan will be developed for each of the 30 soum center utilities established through the project.

(iii) *Preparation of technical and feasibility studies for the configuration and construction of small renewable or renewable-diesel hybrid systems and soum center electric grids rehabilitation (cost: $400,000, financing: $400,000 GEF).*

Preparation of technical specifications and tender documents for both network rehabilitation, generation expansion using local renewable energy (wind and solar) resources, and exploration of local private sector interest in equity participation or management contract.

(iv) *Provision of cross-sector assistance to soum-level public institutions on energy management (Cost: $50,000, financing: $50,000 IDA)*.

Energy management assistance (focusing on end-use efficiency improvements) to soum-level public institutions, such as schools and hospitals.

- ***Investments*** in

(i) *Rehabilitation of mini grids in the 30 off-grid soum centers where users association and soum utility will be established (cost: $900,000, financing $900, 000 IDA).*

(ii) *Conversion of existing diesel generation plants to renewable or renewable-diesel hybrid generation systems based on specific site conditions and in about 20 soums centers where mini grids are rehabilitated (cost: $8,300,000, financing: $1,400,000 GEF, $2,100,000 IDA, $2,000,000 Dutch Government, and $2,800,000 GoM).*

A framework agreement will be reached whereby soum centers that satisfy certain criteria (e.g. community involvement through users association, rationalization of tariff and billing, etc.) will be assisted to obtain further improvements. This will be done in two stages: first, the distribution grid will be rehabilitated for 30 soum centers on condition that a soum users' association and a functioning soum utility exist; second, for about 20 soum centers with a rehabilitated distribution grid and a viable utility, RET investments can be realized on condition that the soum is willing and able to co-finance the investments to a certain extent.

Component C: Institutional Capacity Building (US$1.31 million total cost: $0.6 million GEF, $0.21 million IDA, and $0.5 million in kind support from GoM). This component will strengthen national renewable energy policy development and support project implementation by:

- *Assistance in development of a regulatory framework and associated subsidiary legislation for grid-connected renewable energy systems (cost: $400,000, financing: $190,000 GEF, $110,000 IDA, and $100,000 GoM);*
- *Project management, monitoring and evaluation, and assistance in the institutional development of the National Renewable Energy Center[13] through training, business planning and work program development in view of its responsibilities in the implementation of the national renewable energy agenda (cost: $910,000, financing: $410,000 GE, $100,000 IDA and $400,000 GoM); and*

[13] NREC reports directly to the Ministry of Fuel and Energy and has a total roster of 60 staff. It is created (rather, transformed) from the former Renewable Energy Corporation, which was government-funded and had been in operation for about two decades. The creation of NREC is in response to the much expanded renewable energy agenda of GoM.

Annex 5. Project Cost

MONGOLIA: Renewable Energy and Rural Electricity Access Project

1. Estimated Project Costs by Costing Category

	Name	Subtotal	Goods	Services	Training & Workshops	Incremental Operating Costs	Subsidies
Component A	**Herders' Electricity Access**	**$11,600,000**	**$ 135,000**	**$ 645,000**	**$ 120,000**		**$10,700,000**
A1	Sales and Service Network Development	$ 100,000		$ 10,000	$ 90,000		
A2	Quality Standards and Compliance	$ 200,000	$ 35,000	$ 165,000			
A3	Marketing and Sales/Service Support	$ 600,000	$ 100,000	$ 470,000	$ 30,000		
A4	Smart Subsidy	$10,700,000					$10,700,000
Component B	**Soum Center Electricity Service**	**$10,090,000**	**$ 9,200,000**	**$ 885,000**	**$ 5,000**		
B1	Soum Center Utility Policy and Regulation	$ 80,000		$ 75,000	$ 5,000		
B2	Soum Center Capacity Building	$ 360,000		$ 360,000			
B3	Feasibility Studies	$ 400,000		$ 400,000			
B4	Energy Management Assistance	$ 50,000		$ 50,000			
B5	Rehabilitation of Soum Center Power Grids	$ 900,000	$ 900,000				
B6	Renewable or Renewable-Diesel Hybrid Systems	$ 8,300,000	$ 8,300,000				
Component C	**Institutional Capacity Building**	**$ 1,310,000**	**$ 65,000**	**$ 1,095,000**		**$ 150,000**	
C1	NREC Institutional Development, Project Management, Monitoring & Evaluation	$ 200,000 $ 710,000	$ 65,000	$ 200,000 $ 495,000		$ 150,000	
C2	National Policy and Regulation	$ 400,000		$ 400,000			
	Total Project	**$23,000,000**	**$ 9,400,000**	**$ 2,625,000**	**$ 125,000**	**$ 150,000**	**$10,700,000**

2. Financing by Fund Source

	Name	Subtotal	GEF	IDA	GoN	GoM
Component A	**Herders' Electricity Access**	**$ 11,600,000**	**$ 900,000**		**$ 4,000,000**	**$ 6,700,000**
A1	Sales and Service Network Development		$ 100,000			
A2	Quality Standards and Compliance		$ 200,000			
A3	Marketing and Sales/Service Support		$ 600,000			
A4	Smart Subsidy				$ 4,000,000	$ 6,700,000
Component B	**Soum Center Electricity Service**	**$ 10,090,000**	**$ 2,000,000**	**$ 3,290,000**	**$ 2,000,000**	**$ 2,800,000**
B1	Soum Center Utility Policy and Regulation			$ 80,000		
B2	Soum Center Capacity Building		$ 200,000	$ 160,000		
B3	Feasibility Studies		$ 400,000			
B4	Energy Management Assistance			$ 50,000		
B5	Rehabilitation of Soum Center Power Grids			$ 900,000		
B6	Renewable or Renewable-Diesel Hybrid Systems		$ 1,400,000	$ 2,100,000	$ 2,000,000	$ 2,800,000
Component C	**Institutional Capacity Building**	**$ 1,310,000**	**$ 600,000**	**$ 210,000**		**$ 500,000**
C1	NREC Institutional Development,			$ 100,000		$ 100,000
	Project Management, Monitoring & Evaluation		$ 410,000			$ 300,000
C2	National Policy and Regulation		$ 190,000	$ 110,000		$ 100,000
	Total Project	**$ 23,000,000**	**$ 3,500,000**	**$ 3,500,000**	**$ 6,000,000**	**$ 10,000,000**
	Base Cost of the Project	$ 21,976,000	$ 3,266,000	$ 3,190,000	$ 5,810,000	$ 9,710,000
	Physical Contingencies	$ 438,000	$ 67,000	$ 143,000	$ 95,000	$ 133,000
	Price Contingencies	$ 586,000	$ 167,0000	$ 167,000	$ 95,000	$ 157,000

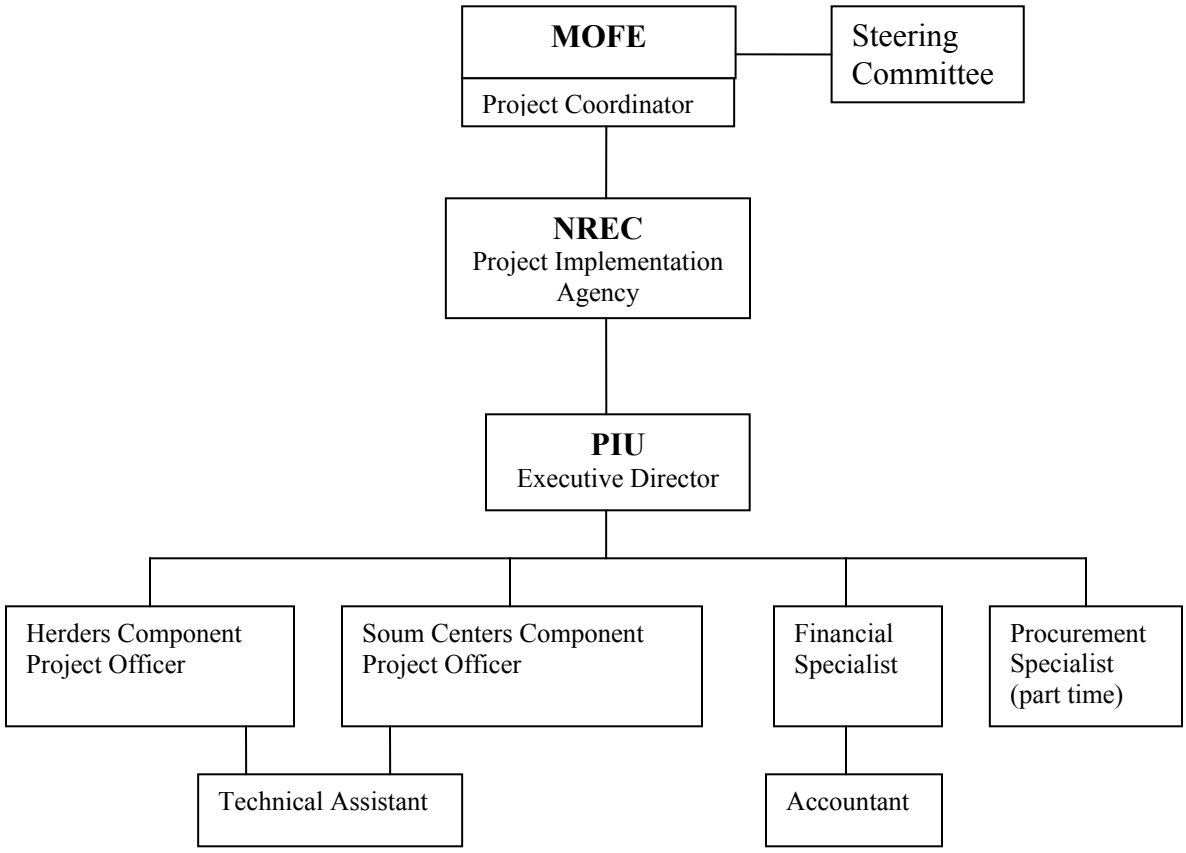
Note: (1) Physical contingencies are assumed to be 5% and are applied to all investment costs, except smart subsidies; (2) Price contingencies are assumed to be 5% and are applied to all costs, except smart subsidies.

Annex 6: Implementation Arrangements

MONGOLIA: Renewable Energy and Rural Electricity Access Project

1. Overview

The Ministry of Fuel and Energy has entrusted the National Renewable Energy Center (NREC) to implement the project. NREC will establish by project effectiveness date a Project Implementation Unit (PIU) with adequate staff to manage day-to-day activities of the project, including contracting, procurement, supervision, and monitoring and reporting. MOFE has appointed a ministry-level coordinator for the project. A steering committee comprising key staff of the Ministries of Finance, Fuel and Energy will be established. It will meet as needed but at least twice per year to review project implementation and provide guidance for the project. The following diagram depicts the project management structure:



The implementation of the Herders' Electricity Access component will take place in two phases. During the initial phase (1-2 years) the basic foundations of a retail network will be put in place and piloted: equipment quality standards and warrantee requirements will be introduced, marketing and information campaigns will be carried out, certified equipment will be sold through certified private dealers and their aimag and/or soum Sales and Service Centers, the smart subsidy scheme will be implemented, and local banks will be involved in related financial services to herders and dealers, such as payments and consumer loans/credits. Most systems sold during the initial phase will be procured through international competitive bidding based on

aggregated orders from certified dealers. The systems will be pre-financed by an ear-marked subsidy budget of about $6.7 million from GoM, in common agreement with certified local retailers for purposed of inventory management. During the second phase the retail network will be improved to serve the herders more efficiently. All equipment and system sold during the second phase will be procured by certified dealers based on their own retail needs. A regularly updated catalog of certified equipment and systems will be use to help herders' purchase decisions. The subsidies will be disbursed to dealers based on proof of eligible sales. The final cost of an eligible SHS or WTS to a first-time buyer (herder household) will be the delivered cost (retail price plus cost of shipping and handling) minus the applicable subsidy. The PIU will be responsible for monitoring and validate the sales.

The Soum Center Electricity Service component will require a systematic community development effort, whereby a soum end-users association is created, and the soum electricity service is transformed into a commercially oriented business (soum center utility) run by a private entity. Contractual arrangement will be developed (flexible and tailor-made for each soum), between soum government (current asset owner) and the soum utility. Ownership of the generator and the distribution system will remain with the soum government while alternative arrangements will be studies and proposed during project implementation. Energy efficiency of the local network and of end-user appliances will be promoted. The development of hybrid diesel-renewable electricity systems and the selection of off-grid soum centers will be evaluated by the PIU according to criteria set by the project. These arrangements will be piloted in 2-4 soum centers and will be improved and expanded to an additional 16-18 soum centers.

The National Capacity Building component will be implemented by NREC in consultation with MOFE and other concerned government agencies, concerned NGOs and private sector stakeholders.

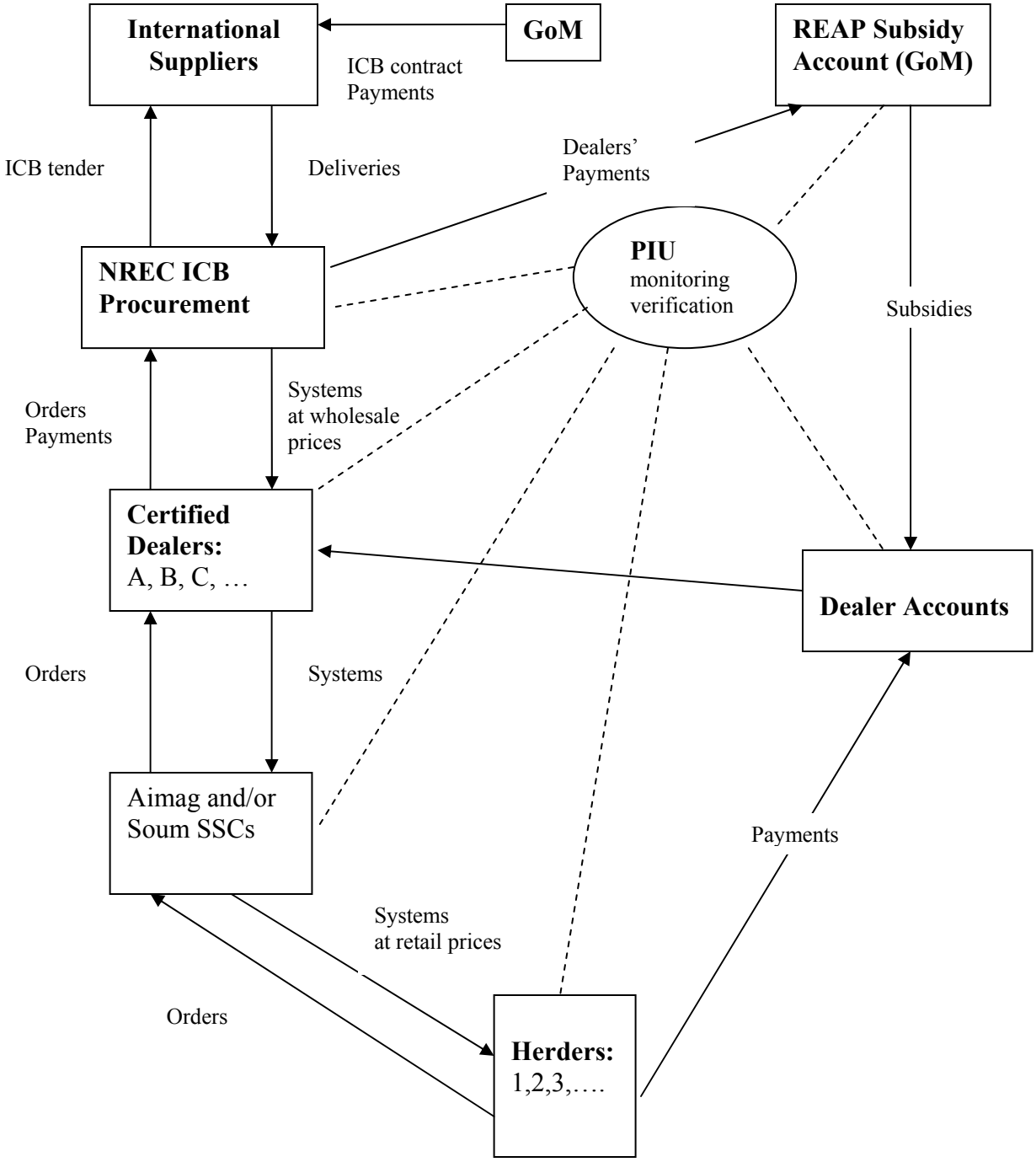
The confirmed GoM's co-financing in the project is $10 million and there are possibilities of subsequent government contributions during project implementation. In order to maintain the consistency in project design and implementation a mechanism for the use of subsequent GoM contributions will be agreed with IDA during project implementation.

2. Herders Electricity Access Component

Currently there is almost no retail of SHSs and small WTSs outside of Ulaanbaatar. Sales of SHSs and small WTSs to herders through private dealers, estimated at about 1000 systems per year, are almost exclusively transacted in one large market located in Ulaanbaatar. The rural retail and service network for SHSs and small WTSs envisioned by the project will have to be built from ground up. In order to deal with an expected surge of demand at the start of the project and at the same time setting and ensuring the basic quality standards of equipment and systems, a two-stage approach to the market development is adopted, with the first stage focusing on downstream retail capacity building and the second stage aiming at scaling up.

2.1 Stage 1: Retail Network Development

In the first one to two years of the project, support will be given to qualified private dealers to set up their distribution channels. To help meet the expected initial surge of demand and ensure that the initial batches of systems supplied meet the project's quality requirements, an initial order of SHSs will be procured through international competitive bidding (ICB) pre-financed by $6.7 million of GoM subsidy funds. These systems will then be delivered in several batches to NREC's warehouse in UB according to the actual orders collected by certified dealers over 1-2 years. The dealers will purchase the systems at whole sale prices (ICB price plus warehouse cost) from NREC and will then retail the systems to herders at marked-up prices plus shipping and handling costs. The recovered funds (the wholesale price) from the dealers will be recycled back to the project's subsidy account to back up subsidies for systems sold to herders. This process is depicted in the diagram below.



The following activities (not necessarily following the numbered sequence) will take place:

(i) **Selection of dealers**: qualified dealers will enter contracts with the project to retail certified solar or wind systems to herders;

(ii) **Herders registration**: a registry record of herder households will be obtained to facilitate the monitoring and evaluation of the project, as well as for subsidy verification;

(iii) **Setting up of the retail/service network**: the network will be established and efficiency improved overtime and may start with a limited number of SSCs each covering a large geographical area;

(iv) **Development of technical specifications**: minimum quality and warrantee requirements will be developed for each component of a complete system and will form the technical basis for the bidding document;

(v) **Marketing and information campaign:** A national information campaign about the herders' electrification program will be launched by the project. Specific information will be made available to herders in the initial-phase aimags, including available systems, estimated costs, subsidy amounts, and how and when they may obtain the systems;

(vi) **Collection of orders:** participating dealers will collect orders from herders via SSCs at aimag and/or soum levels and submit the aggregated orders (by certain deadlines) to NREC;

(vii) **ICB Procurement:** complete systems will be procured from international suppliers and delivery will be made according to aggregated orders from dealers and technical specifications provided by the project;

(viii) **Retailing of systems:** participating dealers will buy the systems at wholesale prices from NREC and will retail the systems to the herders via SSCs in aimags and/or soums. The retail prices will vary by final delivery (or pickup location and include the whole sale cost plus a markup to cover shipping and handling costs.

The financial management and subsidy administration in this stage will involve:

(i) **Establishment of the Subsidy Account(s) by the NREC**: to administer the funds to be contributed by the GoM for the purposes of financing the price subsidies of SHSs and small WTSs. The subsidies financed by the Government of Netherlands will be paid out of a Netherlands Grant Designated Account;

(ii) **Establishment of national deposit accounts at national banks with soum-level presence by participating dealers**: special dealer accounts will be established to which any herder household from any soum will be able to deposit money for payments for the purchase of either a SHS or a small WTS;

(iii) **Development of a monitoring and verification protocol** for subsidy administration, including the design of an invoice for tracking and proof of transactions;

(iv) **Payment for ICB procurement**: the ICB procured systems will be pre-financed by about $6.7 million GoM funds;

(v) **Dealers' payment for wholesale systems:** participating dealers will purchase the systems at wholesale prices (ICB prices plus warehouse costs) according to herders' orders and delivery schedules. These payments will be transferred to the NREC's Subsidy Account;

(vi) **Herders' payments for retail systems**: a herder household will pay his/her cost of the system through his/her dealer's account. This requirement establish a record for sales verification needed for subsidy administration, The herder's cost of a system equals to the value of the retail price of the system minus the subsidy amount;

(vii) **Disbursement of subsidies:** on confirmation of final sales by PIU, matched subsidies will be transferred from the Subsidy Account to a dealer's account. The confirmation of final sales will require reviewing the following documentations:

- Sales invoices (designed by the project) which have detailed identification information of the herder, detailed information of the specific system (brand/model, manufacturer, power rating, components and serial numbers, etc.), signatures of dealer, sale and service point, and herder;
- Dealer's payment records for (wholesale) purchasing the delivered systems, including the detailed system information described above;

2.2 Retail Network Scaling-up

It is envisioned that in one to two years' time, after the completion of the initial orders assisted by the project, the equipment quality standards will have been introduced and the certification program implemented, the participating dealers will also have improved capacity for supply chain management, enabling them to procure and distribute certified systems and components more efficiently and competitively. The sales network will be expanded with more SSCs providing more efficient service to herders. The project will focus on ensuring that systems and components sold to herders are compliant with the quality standards and warrantee requirements established by the project, as well as building of the service capacity.

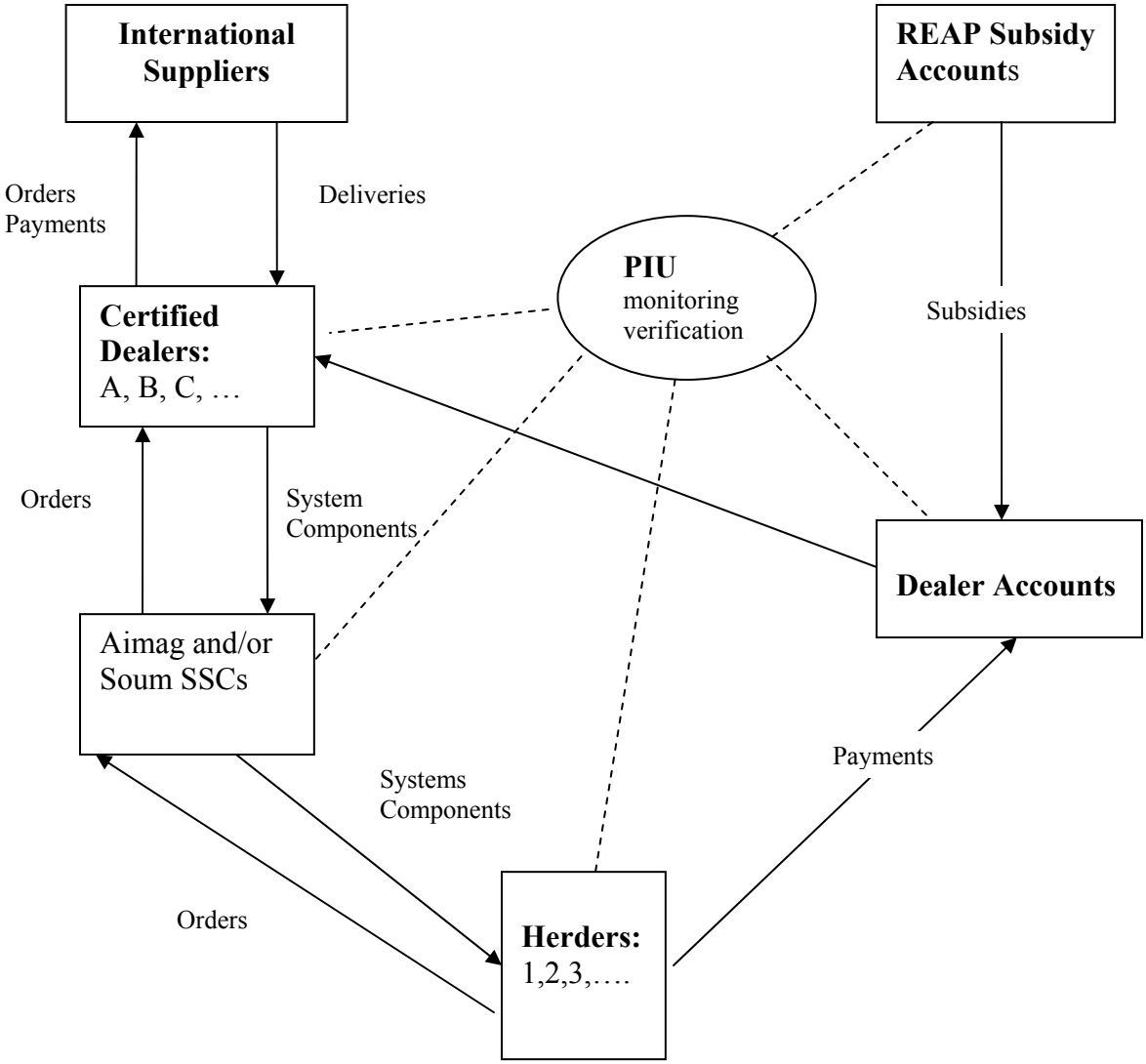
In this second stage of market expansion, herders will buy or order complete systems or specific parts (such as CFLs and batteries) from a catalog of certified systems and components available through certified suppliers via aimag or soum SSCs or at special sales events organized by the dealers. Herders will continue to use the dealer's account to make payments (the balance of the system retail price minus subsidy). Subsidies will be disbursed (from the subsidy accounts of the project) to participating dealers based on verified sales of certified systems to eligible herder households.

Prior to the adoption of these implementation arrangements the following activities need to be completed (i.e., during the fist stage):

(i) **Introduction of quality standards and warrantee requirements** for systems and/or components;
(ii) **Introduction of certification procedures** for systems and components;
(iii) **Development and introduction of a catalog of certified systems and components** (to be updated periodically); and
(iv) Development and introduction of a battery management program.

The subsidy administration remains the same as in the first stage.

The second stage implementation arrangements are depicted in the following diagram:



3. Soum Center Electricity Service Component

The project will support 30 off-grid soum centers (out of about 70 soum centers which are considered too remote to be connected to the grid in the next 10-20 years) to improve the level of electricity services through management improvement and rehabilitation of the distribution network. In addition, about 20 out of the 30 soum centers with improved management structures will also benefit from RET investments.

The selection of the 30 soums for management improvements and network rehabilitation has been demand driven to a certain extent. Soums that demonstrate the strongest willingness to undertake the changes will receive priority treatment. Criteria for such selection are:

- request inclusion in the program;
- detailed information about the soum utility operation including customer base, load

pattern, tariff-payment details plus a general economic overview of the soum's activities

- commitment to organize customers into a soum users' association; all households should be invited to participate;
- commitment to transform the soum utility (if there is such a thing) into a more commercially run entity; and
- pledge to pay a connection fee prior to physical works in the soum start (all households and institutions in the soum should agree)
- pledge to pay for the consumption of consumed electricity.

The *main partners* that play a role in the supply of soum electricity are:

(i) the owner of the assets (the soum government [SG]; assets are: the diesel generator(s) and the distribution system);
(ii) the consumers (soum associations [SAs], represent all users of electricity in the soum), and
(iii) the operator of the soum electricity system. A private entity will be involved in generation, distribution, and billing.

3.1 Policy and Regulations Studies

The PIU has hired international and local consultants to carry out basic studies which will provide a basis for rationalizing soum center electricity tariff and billing, assets management, and operational management.

3.2 Soum Center Capacity Building

For each soum center where the project will intervene, an agreement will be signed between the Soum Governor and the PIU stating that the Governor agrees that the proposed changes are indeed desired and that they have been discussed with the population, and that full cooperation will be provided. Standard contracts for soum utility management will be developed under the policy and regulations subcomponent. In addition, a time table for applying the first three Work Packages (soum center capacity building, local grid rehabilitation, and investment in hybrid generation plant) will be included, and responsibilities for each of the parties (Soum Government, Soum Association, Soum Utility, and PIU) will be outlined.

The work for this (and the following) subcomponent will be carried out in five consecutive steps:

1) Soum association & capacity building (WP1)
2) Soum utility & capacity building (WP2)
3) Rehabilitation of distribution network (WP3)
4) Configuration of RET system and feasibility study (WP4)
5) Monitoring (part of National Capacity, Component C)

Steps 1, 2, 3 and 5 are carried out in 30 soums; step 4 in about 20 soums. The main outputs are:

(i) creation of a soum association (max 30 soums)
(ii) creation of a soum utility (max 30 soums)
(iii) realization of the distribution (max 30 soums)

(iv) realization of the RET investment (max 20 soums).

Establishment of Soum Association: All 30 selected soum centers will be visited by a local team consisting of a sociologist and/or anthropologist, economist to discuss the procedures for realizing all changes. The PIU will issue contracts to local firms for the realization of 3-5 soum association. In the first visit the project concept will be explained and a memorandum of understanding will be signed. The benefits to the community will be explained but also the cost (participation, involvement, and possibly in the end higher cost, but for a much better level of service). The need to establish a soum association will be explained.

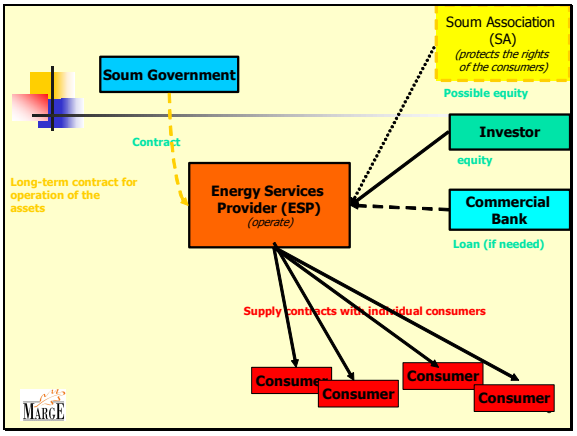
Several visits will be required in a short time to accompany the soum population in organizing themselves through the creation and development of a soum association of electricity users. In the presentations the next steps will be explained and the requirements to move to a higher level: creation of a soum utility and rehabilitation of the distribution network. The participants will be informed that having formed the soum association is a requirement to move to the next step. If the soum association is established in principle, it can be formalized. The details of work involved with the establishment of the soum associations are described in the project implementation plan.

Establishment of Soum Utility: A tailor-made solution will be sought in each soum for improving management of the soum electricity system, allowing for maximum flexibility and specific wishes prevailing among the soum population. This requires a systematic and fully participatory approach involving all soum households, public service institutions, local government and private businesses. Several meetings with as many stakeholders as possible are needed to explain the process and obtain a commitment to cooperate from all. Since private businesses should be more involved in the electricity operations, a specific effort is required to try to implicate them. This requires a two staged approach: firstly, to demonstrate that soum electricity systems can be run profitably. Prior to this, the community as a whole (including all stakeholders) should express its consent and commitment to the proposed changes. Selection criteria will be developed to estimate their willingness and ability to adopt the changes.

A private business (or business man/woman, or investor, whether local or from another soum) will assume the responsibilities for electricity generation and distribution. He/she will create a separate and commercially run company to carry out the agreed tasks, and signs a contract with the SG for doing so.. The responsibilities include the following tasks:

- Generate electricity, maintain the equipment, and minimize the supply costs
- Distribute electricity to end-users, maintain the distribution system and minimize the distribution costs
- Billing, collection, and assure that all clients pay on time
- Apply commercial procedures, minimizing costs, increasing efficiencies and increasing service levels wherever possible.
- All consumers should pay for their consumption; lifeline tariff could be applied to cross-subsidize the first 10 kWh/month; large consumers should pay higher tariffs.

Figure: System operated by a private entity



The PIU has issued expressions of interest to advertise the opportunity for an entity (e.g. a private firm) to start managing the soum system. A selection will be made if there is more than one potential candidate provider. Selection criteria include:

- Commercial capacity (ability to run a viable business)
- Technical capacity (in-house or on-call, e.g. from another utility, firm, etc)
- Ability to eventually buy the equipment from the SG
- Guaranteed price of electricity (although this may be too early to apply).

Once it is agreed which organizational setup will be chosen in the soum, contracts will be signed between the parties:

- SG and provider, including
    - Agreed tariffs, including rules for tariff changes
    - Royalty payment to SG (to be discussed, but not applied during the first phase)
    - Penalty clauses
    - Termination clauses; initially the contract is for some 6 months.
- Provider and each household.

A new company will be created, to be managed by the provider (or the SA). The company starts to operate the system and supply electricity on a regular basis. The company benefits from technical assistance provided by the project, receives feedback from NREC, and after a set period will be audited to distill lessons learnt. If the performance is satisfactory from the point of view of all three parties (SG, SA, provider), the contract will be extended into a long-term contract in which issues such as royalties, buy-out, etc. are addressed.

3.3 Investments in Soum Mini Grid Rehabilitation

Immediately following the creation of these organizations, some energy efficiency investments and rehabilitation of the network will take place, but only if the soum association exists and has been involved in the whole process, and if the new soum utility structure has been identified and is operational.

The PIU will be heavily involved in procurement as there will be much overlap of equipment and materials needed for the different soums, hence much room for scale-economies from the bulk procurement of equipment and materials. It is possible to combine WP 2 and WP3 as the study can be carried out at the same time; however, the rehabilitation investments can only be realized if WP2 and WP3 have been duly completed.

3.4 Investments in Renewable or renewable-diesel Hybrid Systems

This subcomponent consists of two elements: (i) RET configuration (WP4), and (ii) installation and commissioning. RETs will be used to create a hybrid diesel-RET electricity supply system. Capital subsidies will be provided in the form of a full pre-financing of the equipment. Thus the full RET equipment cost will be applied in such a way that users are allowed to pay for it over time and can afford to replace it at the time it needs replacement. In this way operational costs can be substantially reduced, leading to lower tariffs that in turn are expected to lead to larger consumption and thus better service levels. However, it is essential that amortization of the equipment be included so that the equipment can be replaced at the end of its useful life.

RET investment will only take place in those soums where soum management issues have been resolved and where the rehabilitation has been successfully implemented. Since there are only about 20 soums that can be included in the investment phase, a selection must take place. Criteria include:

(i) soum utility and soum association operational and appear to be viable and sustainable; this is measured through (a) applied tariff that allows for full cost recovery of all expenditures and investments, and (b) satisfaction of users with the services provided;
(ii) soums that provide the largest amount of co-financing (on an average per household basis, whereby small consumers contribute less than large consumers) and have actually deposited this in an escrow account; (measured as the number of months prepaid, of the estimated electricity consumption)
(iii) soums with a healthy economy, showing a steady load-growth for electricity since the start-up of the soum utility (number of private individual generator sets is use)
(iv) soums where a good renewable energy regime matches the load curve (average wind speed > 6 m/s and/or insolation > 4.5 kWh/m2/day and >2600 hrs/year)
(v) economic rate of return on investments expected to exceed a certain value (to be determined, and expected to be no less than 12%)

Procedures to be followed:

(i) The PIU will decide which 20 out of the 30 improved soums should be selected for the RET investment phase using the above criteria;
(ii) The PIU commissions a feasibility study in 20 soums (WP4). A contract is issued to a firm for a batch 3-5 soums. The firm will closely work with the Soum Utilities and the Soum Associations. Based on the outcome of the work during Project preparation, the procedures to be put in place will be adjusted by the PIU. To obtain sufficient qualified consultants and to select the most qualified one, the PIU will prepare a request to express interest to be published in UN Development Business. From the consultants who expressed interest, the PIU will select the most qualified

one and request the selected consultant to prepare a proposal.

(iii) The PIU discusses the different configurations with the Soum Association, Soum Utility, and Soum Government, and a decision is taken on the configuration to be chosen for this soum. Criteria for this decision are many, including the total amount of budget available given the targets under the project, the own contributions from the soum participants (association and utility), the economic rate of return for the project investment, and the likely tariff that needs to be charged. The views of the soum association will be explicitly discussed, as its members will have to pay the new tariff for their consumption.

(iv) Contract are signed with the PIU outlining the responsibilities of each partner, including the obligation to charge (and to pay) a tariff that allows the replacement of the RET equipment at the end of its service life.

(v) PIU then organizes the procurement of the equipment; the best method is yet to be determined, but it is likely that bids are prepared for batches of 3-5 soums, including all equipment, transportation and installation on-site plus commissioning and testing.

Specification of RET Equipment and Feasibility Study: For each soum a detailed system design needs to be made and the proposed RET system needs to be specified. This includes details like exact location and position. This work will be done by a team of international and national consultants. The TOR for this work have been prepared during project preparation (not available yet). Based on the detailed design the investment cost can be estimated. With the expected load curve and tariff structure, revenues can be estimated. Based on this, a feasibility study can be conducted.

Installation and Commissioning: As soon as the configuration options are available, the consultant will discuss these with the Soum Association, the Soum Utility, Soum Government, and the PIU. The pros and cons will be discussed and a decision will be made as to the selected configuration. The actual configuration will have an impact on tariffs (as depreciation needs to be incorporated) that will have to be paid by consumers. The Soum Association should therefore have a say in the configuration choice.

Once the choice is made, investments will be realized. The procurement will be arranged by the PIU and if possible at all, combined orders will be placed (for 1-3 soum centers combined) to obtain scale-economies. Procurement of the systems will include installation and testing. After the systems have been installed an independent consultant will witness the installation to confirm the system functions as specified. Upon successful commissioning final payments can be made to the equipment supplier. The PIU will manage the commissioning.

3.5 Monitoring and Evaluation (M&E)

The project will develop a M&E framework to properly assess the social and economic benefits of the project. Following agreement of such framework a contract will be issued for the monitoring of the soums with improved management systems and the soums with hybrid RET systems. This will be in addition to the annual audit of the Soum utility accounts and initially two-monthly site visits to provide an independent view of the functioning of the utility. For soum utilities that appear to be functioning correctly, this schedule may be reduced on request of

the PIU. The audits will be realized at least 5 years in a row. Lessons learned, mistakes to be avoided, will be identified and communicated for further replication. Procedures to be put in place will be developed by the PIU. To obtain sufficient qualified consultants and to select the most qualified one, the PIU will prepare a request to express interest to be published in UN Development Business. From the consultants who expressed interest, the PIU will select the most qualified one and request the selected consultant to prepare a proposal.

4. Overall Project Monitoring and Evaluation

4.1 REPORTING REQUIREMENTS

Annual Plans: Before the beginning of each calendar year, the PIU will prepare an Annual Plan in which the PIU will specify what activities will be undertaken in the coming calendar year. The Annual Plan needs to be consistent with the PIP. It needs to include the required budget for the calendar year and expected disbursement. After approval of the Annual Plan by MOFE and the No Objection from the World Bank the activities specified in the Annual Plan are approved and can be implemented without requiring additional approval, except for the required World Bank No Objection for contracts above the threshold. Activities not specified in the Annual Plan, because these were not known or not considered needed when preparing the annual plan, can still be carried out, subject to approval of MOFE and World Bank No Objection.

The Draft Annual Plan must be submitted to the World Bank for review on or before 31 October. A World Bank No Objection to the annual plan needs to be obtained before 31 December.

As the project is expected to start in October 2006, the first Annual Plan will cover the last three months of 2006 and the whole of 2007. The first Annual Plan needs a World Bank No Objection before the start of implementing RERAP. An approved annual plan is a condition for effectiveness.

Progress Reports: To inform MOFE and the World Bank on implementation progress, the PIU will prepare simplified quarterly reports in the form of reporting tables. The main reporting table will provide for each activity a brief description of progress during the reporting period and the status at the end of the period The PIU staff responsible for that particular activity will provide this information. Other reporting tables will be added as annexes. Appropriate reporting tables will be prepared by the PIU during the first quarter of implementation. Based on comments from the World Bank team and others, these tables will be further refined to come to a user friendly, quick and convenient reporting system.

The quarterly progress reports will be submitted to MOFE and the World Bank within 45 days after the end of the period. The first quarterly report is due by June 30, 2007.

Annual Progress Reports: Within 3 months after the end of the calendar year the PIU will prepare a detailed annual report on the progress of RERAP during the year and the status at the end of the year. The format of the annual report will be developed by the PIU. Examples of annual reports from other GEF/World Bank projects will be reviewed for guidance.

End of Project Report: At the End of RERAP a detailed end of project report will be prepared. It will provide an overview of the work carried out under RERAP and the status of all activities at the end of the project. The format for this report will be discussed and agreed at least 6 months before the end of the project.

4.2 Monitoring and Evaluation

To monitor the progress and evaluate the success of the project performance indicators have been established. The PIU needs to follow the progress against these indicators closely. When insufficient progress is made or intermediate targets are not met, the PIU may need to identify ways to address this. Problems with meeting targets should be openly discussed with the World Bank supervision team in order to jointly identify measures to address this. This may require modification of the project approach. When these modifications are minor they can be made when all parties agree. Major modifications will require an amendment of the project agreements. The values for the different indicators will be obtained from the six monthly, annual and end of project reports. Most of these numbers are easily obtainable from RERAP operation. Some, however, are more difficult to obtain or measure. For this the PIU may need to commission separate studies.

4.3 World Bank Supervision and Evaluation

Two World Bank supervision missions are foreseen by-annually. To make these supervision missions effective the PIU will prepare these missions well and make sure that all PIU staff is present during these supervision missions. In order to allow sufficient time for preparing these missions, the World Bank will inform the PIU of their plan for supervision mission at least 6 weeks before the mission. The PIU will check internally and with MOFE if the proposed timing is convenient. If not, the PIU will propose alternative dates.

Annex 7: Financial Management and Disbursement Arrangements

MONGOLIA: MN – Renewable Energy and Rural Electricity Access Project

Summary

The Financial Management team has conducted an assessment of the adequacy of project financial management system of the Mongolia Renewable Energy and Rural Electricity Access Project. The assessment, based on guidelines issued by Financial Management Sector Board on November 3, 2005, has concluded that the project meets the minimum Bank financial management requirements, as stipulated in BP/OP 10.02. In the FM team's opinion, the project will have in place an adequate project financial management system that can provide, with a reasonable assurance, accurate and timely information on the project status in a reporting format agreed with the project as required by the Bank.

Funding sources for the project include a credit from IDA, grants from Global Environment Fund (GEF) and Government of Netherlands (GoN), and counterpart funds from Government of Mongolia (GoM). IDA credit and grant proceeds will flow from the Bank into project designated accounts (DAs). The DAs will be established at commercial banks acceptable to the Bank and managed by a Project Implementing Unit (PIU). Counterpart funds will flow from the GoM into a project operation account, which will be established at a commercial bank and managed by the same PIU.

Audit arrangements

The Bank requires that project financial statements be audited in accordance with standards acceptable to the Bank. In line with other Bank financed projects in Mongolia, the GoM, through MOF will appoint an independent external auditor, acceptable to the Bank, to conduct annual audit of the project accounts, in accordance with International Standards on Auditing, under terms of reference satisfactory to the Bank. The audit will be financed from the proceeds of the credit. The auditors will: (a) express an opinion on the annual financial statements; (b) determine whether the Designated Accounts have (i) been correctly accounted for, and (ii) been used in accordance with the financing agreements; and (c) determine the adequacy of supporting documents and controls surrounding the use of Statement of Expenditures (SOEs) as a basis for disbursement. The auditors will also furnish a separate Management Letter, which will (a) identify any material weakness in accounting and internal control; (b) report on the degree of compliance of financial covenants of the Credit and Grant Agreements; and (c) communicate matters that have come to the attention of the auditors which might have a significant impact on the project implementation.

The annual audit report of the project will be due to the Bank within 6 months after the end of each calendar year. This requirement will be stipulated in the financing and grant agreements. The responsible entity and timing for audits are summarized below:

Component	Submitted by	Due date
Audited project financial statements	PIU	June 30 of each year

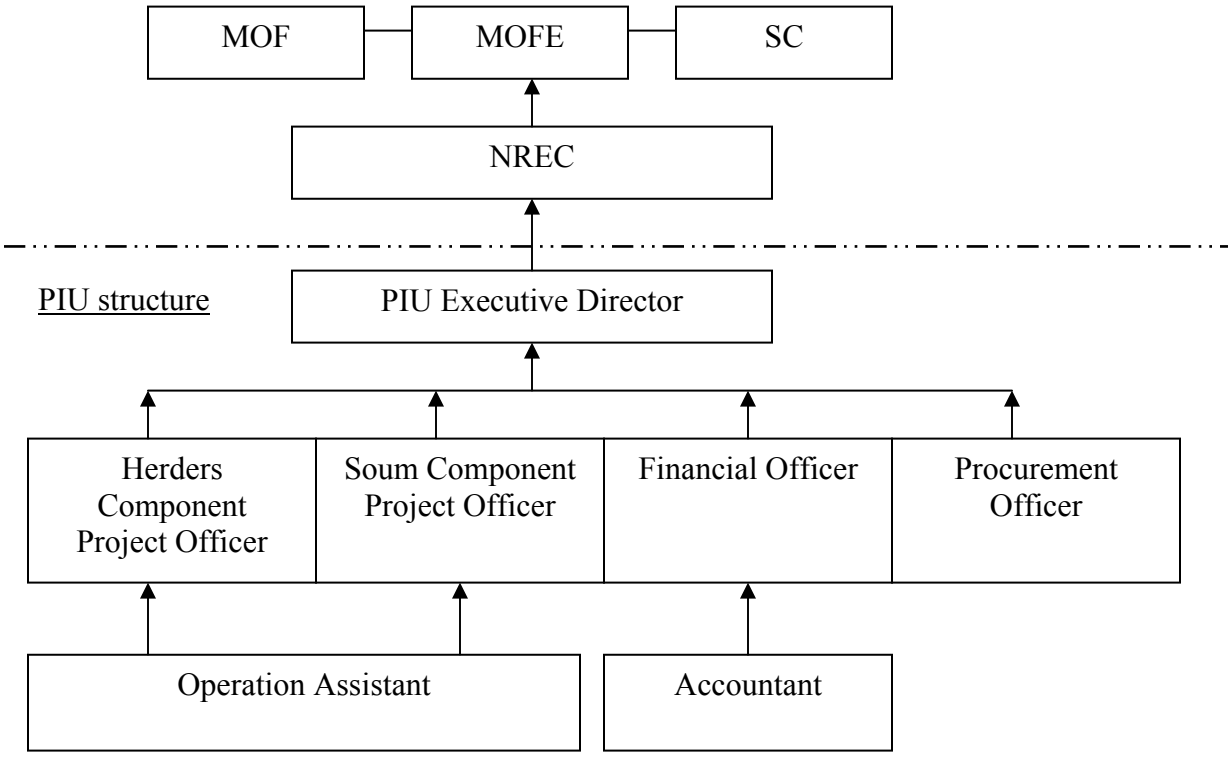
Financial Management and Reporting Arrangements

Implementation Entity

The National Renewable Energy Center (NREC) is responsible for the implementation of the project. The Ministry of Fuel and Energy (MOFE) is the counterpart government agency and has appointed a ministry coordinator for the project. MOFE will chair a multi-agency Steering Committee (SC), comprising deputy ministers of MOFE, Ministry of Finance (MOF) and Ministry of Environment and Resources. They will meet twice a year to review the implementation progress and provide necessary guidance.

NREC has established a Project Implementation Unit (PIU) to manage day-to-day activities of the project, including contracting, procurement, supervision, and monitoring and reporting. The PIU will consist of 7 full time staff comprising of 1 project executive director, 2 operation officers, 1 operation assistant, 1 financial officer and 1 accountant, and 1 procurement officer.

The detailed project organization chart is listed as below:

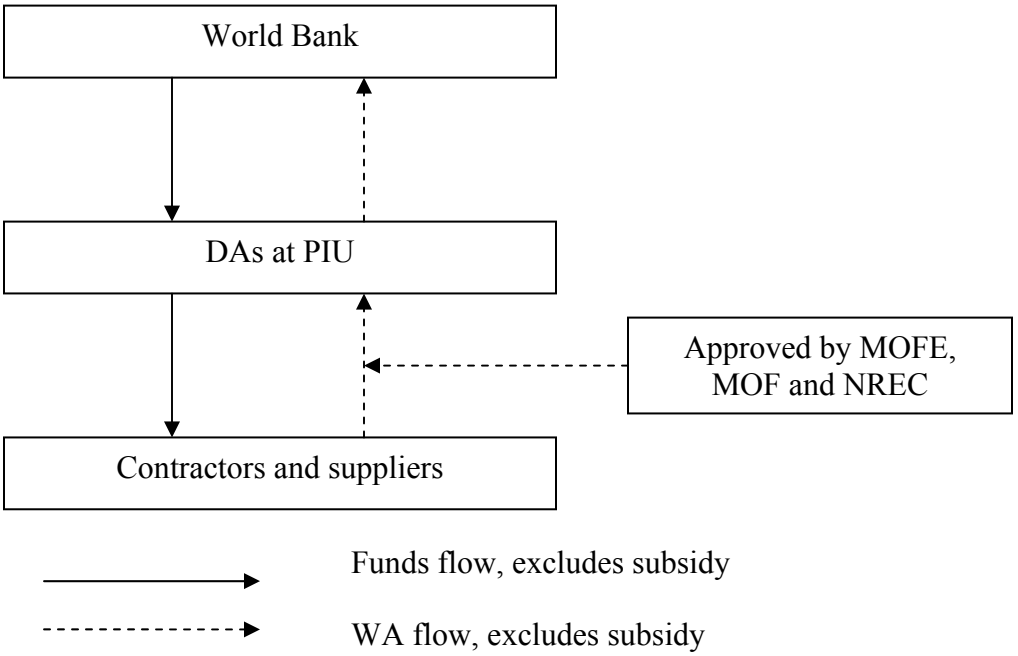


Funds flow

To facilitate disbursements from the Bank and other donors' proceeds, the PIU shall maintain three US dollar designated accounts (DAs) at commercial banks, on terms and conditions satisfactory to the Bank, including appropriate protection against set off, seizure and attachments. One DA is for IDA grant, one DA is for GEF grant and another DA is for GoN grant. The grant

proceeds will flow from the Bank to the DAs. The DAs will disburse against all eligible project expenditures. The authorized allocation of DAs will be discussed and determined between the Bank and Recipient during project negotiation and specified in the Bank's Disbursement Letter.

The withdrawal application (WAs) procedures and funds flow for project components 1 (excluding subsidy), 2 and 3 are described below. For the subsidy in Component A, please refer to Attachment 1 for funds flow and WAs procedures.



Accounting Organization and Staffing

Adequate project financial management staff with educational background and work experience commensurate with the work they are expected to perform is one of the factors critical to the successful implementation of project financial management. The FM team proposed the PIU will, at least, hire a full time financial officer and an accountant who will be responsible for maintaining the overall financial management system of the project, including preparation of project consolidated financial statements, accounting of project funding sources and expenditures, processing withdrawal applications, keeping supplier records and filing the project accounting records and related documents. Based on discussion, observation and review of the job description and requirements for the proposed staffs identified for financial and accounting position in the PIU, the FM team noted that it seems appropriate for the work they are expected to assume.

To strengthen financial management capacity and achieve consistent quality of accounting work, the task team has requested a project financial management manual (the Manual) be prepared by the PIU. The Manual will provide detailed guidelines on financial management, internal controls, accounting procedures, fund and asset management and withdrawal application procedures. A draft of the Manual is due to the Bank by November 20, 2006**.** Once it is received, the FM team will review it and provide feedback to the PIU on suggested changes. A

final version of the Manual will be finalized and distributed to all the relevant financial staff before project effectiveness.

The propose financial officer and accountant in the PIU will lack experience with Bank financed projects. To ensure that financial staffs recruited for the project will have good understanding of Bank's policy and requirements, it has been further agreed that a well-designed and focused training program will be provided by the Bank prior to effectiveness to all relevant staff. The training program will include but not limit to the following:

- Bank's financial management policy and disbursement procedures
- Fund/asset/contract management
- Financial monitoring report requirement
- Format and content of project financial statements
- Audit requirements

Accounting Policies and Procedures

12. The administration, accounting and reporting of the project will be set up in accordance with the Bank requirements. The PIU will maintain dedicated and separate project accounts for all the project activities. The Bank requires borrowers to prepare financial statements in accordance with acceptable accounting standards. The Bank does not mandate a format for annual financial statements. However, where a borrower prepares financial statements on a cash basis, the Bank encourages the adoption of formats laid out in the International Public Sector Accounting Standards (IPSAS) - Financial Reporting under the Cash Basis of Accounting. This project will adopt the cash basis of accounting to prepare the financial statements. Consistent with IPSAS requirements, the financial statements will include the following:

- Project balance sheet
- Statement of receipts and expenditures
- Designated account statement
- Accounting policies adopted and explanatory notes

Reporting and Monitoring

The PIU will prepare Project Reports (PRs) for the project in accordance with PR guidelines issued by the Bank. The PRs will be submitted to the Bank within 45 days of the end of each quarter. The PRs shall include but not be not limited to (a) Discussion of Project Progress; (b) Project Balance Sheet; (c) Sources and Uses of Funds by Disbursement Components; (d) Uses of Funds by Project Activities; and (e) Output Monitoring Report.

The PIU will propose the PR's contents and format according to the project design and cost structure and provide a draft of PR format to the Bank for comments by November 8, 2006. Once it is received, the FM team will review the format and provide feedback to the PIU on suggested changes. The PR contents and format will be finalized before project effectiveness.

Internal Auditing

There is no independent internal audit department for the project. The PIU management, monitoring and yearly external audits will serve as the mechanism to ensure that financial management controls are functioning appropriately.

Disbursement Arrangements

The project will be disbursing using transaction-based disbursements. The proceeds of the IDA credit and grants would be disbursed against project components as shown in the table below

Expenditure Category	IDA Grant		GEF Grant		GoN Grant	
	Allocated Amount (in US$)	Financing Percentage	Allocated Amount (in US$)	Financing Percentage	Allocated Amount (in US$)	Financing Percentage
Component A						
Herders Electricity Access						
1. Sales/service network development	-	-	100,000	100%	-	-
2. Quality standards and compliance	-	-	200,000	100%	-	-
3. Marketing and sales/service support	-	-	600,000	100%	-	-
4. Smart Subsidy	-	-	-	-	4,000,000	100%
Subtotal	-		900,000		4,000,000	
Component B						
Soum Center Electricity Service						
1. Soum utility policy and regulation	80,000	100%	-		-	-
2. Soum level capacity building	160,000	44%	200,000	56%	-	-
3. Feasibility studies for renewable or hybrid systems	-		400,000	100%	-	-
4. Energy management assistance	50,000	100%	-		-	-
5. Renewable or renewable-diesel hybrid systems	2,100,000	38%	1,400,000	26%	2,000,000	36%
6. Soum mini-grid rehabilitation	900,000	100%	-		-	-
Subtotal	3,290,000		2,000,000		2,000,000	
Component C						
National Capacity Building						
1. Project management, M&E, and NREC institutional development	100,000	100%	410,000	100%	-	-
2. National policy and regulation	110,000	37%	190,000	63%	-	-
Subtotal	210,000		600,000		-	
Total	3,500,000		3,500,000		6,000,000	

For subsidies, the disbursement will be made to participating dealers based on confirmed sales of complete systems (requirements for confirmation of sales are described in Annex 6). GoN grant will finance 100% of subsidy disbursement against confirmed sales of 20 to 49 Wp systems and will finance 100% of subsidy disbursement against confirmed sales of 50 to 100 Wp systems when GoM subsidy funds are depleted.

For other co-financed subcomponents, disbursement of IDA, GEF, and GoN grants will be at fixed percentages.

Disbursement methods, such as reimbursement, advance, direct payment and special commitment, will all be available to the project. The SOE limits will be set up in line with procurement post review threshold, as follows: (i) all contracts for goods estimated to cost the equivalent of USD 50,000 or less; (ii) consultant contracts estimated to cost USD 100,000 (firm) / USD 50,000 (individual) or less.

The PIU will retain documentation supporting disbursements during the life of the project and for one year after the receipt of the audit report for the year in which the last disbursement is made. These documents will be made available for review by the auditors and Bank supervision missions. Should the auditors or Bank supervision missions find that any disbursements made are not justified by supporting documentation or are ineligible, the Bank may withhold further deposits to the DA until the Borrower has: (a) either refunded the amount involved or (b) submitted evidence of other eligible expenditures that offset the ineligible amounts.

Financial Management Action Plan

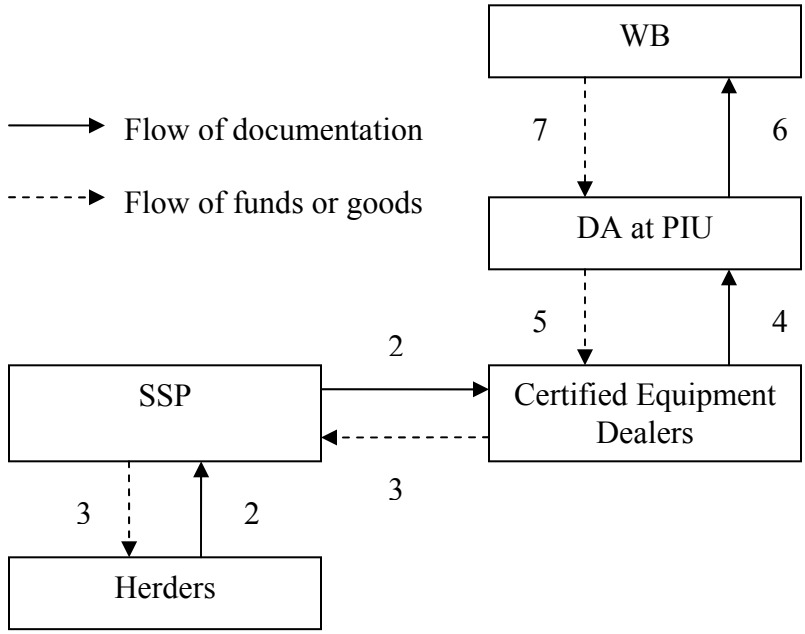
The following time-bound actions are proposed:

Acition	**Responsible person**	**Completion Date**
Recruitment of qualified financial officer and accountant	PIU	Before Effectiveness
Finalised financial management manual and distribution	PIU	Before Effectiveness
In-depth traing to financial staffs on financial management and disbursement	PIU and WB	Before Effectiveness

A detailed supervision plan for this project will be included as part of the Mongolia Audit Strategy document which is currently in process. This document will take into consideration of the size of project and the risk identified.

Attachment 1

Funds and Withdrawal Application Flows for the Subsidy of Component A



Step 1	Advertisement and Catalog exhibition: Herders will be informed of the project, available systems, estimate costs, subsidy amounts, and how and when they may obtain the PV/Wind systems. The catalog of PV/Wind systems are regularly produced and updated. The catalog will be placed and the samples of PV/Wind systems will be exhibited in Aimag or Soum Sales and Service Centers (SSP).
Step 2	Ordering collection: Herders make their orders for PV/Wind systems to SSP. Certified equipment suppliers will collect orders from herders via their SSCs at aimag and/or soum levels.
Step 3	Distribution: Certified equipment suppliers will distribute PV/Wind systems to herders via their SSCs according to orders.
Step 4	Submission of request for subsidy: On quarterly basis, certified equipment supplier will generate a quarterly sales report, including the following documents: individual sales invoices (format designed by the project), herder's payment records (statement of dealer's account), and dealer's payment records (for procured systems). The report should be submitted to the PIU in the first 15 working days of next quarter. The supporting documents should be kept and maintained by certified equipment dealers for review by the PIU, Bank supervision mission and auditors.
Step 5	Disbursed from DA: The PIU will disburse the subsidy to certified equipment dealers based on confirmed sales.
Step 6	Submission of withdrawal application to WB: The PIU will submit withdrawal applications to WB on regular basis.
Step 7	Replenishment from WB to DA of PIU: After review and verification of WAs, WB will replenish the funds to DA.

Annex 8: Procurement Arrangements

Mongolia: Proposed Renewable Energy and Rural Electricity Access Project

A. General

Procurement for the proposed project will be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004; and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004, and the provisions stipulated in the Legal Agreement. The various items under different expenditure categories are described in general below. For each contract to be financed by the grant, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements, and time frame are agreed between the Recipient and the Bank in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

Procurement of Goods and Works: A total of about US$9.5 million of goods will be procured under this project.[14] For the Soum Center Electricity Service Component, goods to be procured will include mainly equipment (and incidental services including installation and commissioning), such as wind turbines, PV modules, battery banks, as well as wires and poles for soum center mini grid rehabilitation. For the Herders' Electricity Access Component, goods required will include laboratory testing equipment, office equipment, a field visit vehicle, as well as SHS and small WTS units required for the first one or two years of the project implementation. Goods estimated to cost US$100,000 equivalent or more per contract will be procured following International Competitive Bidding (ICB) procedures and the Bank's Standard Bidding Documents will be used, including supply and installation contractual agreements. Domestic preference may be applied in bid evaluation in accordance with the Bank Procurement Guidelines. Goods estimated to cost less than US$50,000 equivalent per contract will be procured following shopping procedures and project-specific sample documents for shopping procurement will be prepared and adopted. Contracts for goods meeting the requirements of article 3.6 of the Procurement Guidelines would be awarded on direct contracting basis with the Bank's prior agreement.

Selection of Consultants: A total of about US$2.1 million of consulting services and training is proposed under the project for policy regulation studies and reviews, institutional capacity building, project management and evaluation (including employment of local consultants for the PIU staffing), etc. Contracts for consulting services, each estimated to cost US$100,000 equivalent or more, will be awarded following the procedure of Quality and Cost Based Selection (QCBS); Procedures of Quality-Based Selection (QBS) will be followed for assignments which meet the requirements of paragraph 3.2 of the Bank Consultant Guidelines; Consulting services estimated to cost less than US$100,000 equivalent per contract under this project will be procured following the procedures of Selection Based on Consultants' Qualifications (CQS); Procedures of Selection of Individual Consultants(IC) will be followed for assignments which meet the requirements of paragraph 5.1 and 5.3 of the Bank Consultant

[14] This does not include the ICB procurement of solar home systems pre-financed by GoM funds.

Guidelines; Least-Cost Selection (LCS) will be used for assignments for auditing the PCU accounts.

Training Workshops, Seminars and Promotion Activities: A total of about US$125,000 is proposed for training, workshops, seminars and promotion activities. These activities will be disbursed against reasonable actual costs.

Incremental Operating Costs (IOC): A total of about US$150,000 is proposed for the incremental operating costs for the PIU to cover expenditures of utilities, office equipment, one vehicle and associated operation and maintenance, communication and internet expenditures, in-country travel and per diem allowances for project staff conducting supervisions, etc. The procurement of these expenditures may follow the government procedures acceptable to the Bank and will be disbursed against reasonable actual costs. No government staff salaries will be financed under the project.

B. Assessment of the agency's capacity to implement procurement

The Ministry of Fuel and Energy (MOFE) will be the execution agency of the project and a PIU has been established within the National Renewable Energy Center (NREC) under MOFE. The PIU will coordinate and facilitate the execution of the project activities. All of the procurement activities of the project will be centrally planned and carried out by the PIU with technical supports and participation by the MOFE and NREC. Execution of contracts will be managed by NREC with the PIU's coordination.

An assessment of the procurement capacity of MOFE, its NREC and the PIU was carried out by Bank missions in April 2006. The assessment reviewed the organizational arrangements and the staffing plan for the project implementation, as well as the interactions between the project's staff responsible for procurement and the Government's relevant agencies for administration and finance. To strengthen the procurement capacity of the implementing agencies, an action plan has been agreed, which includes: (1) Preparation of project-specific procurement manual as part of the Project Implementation Manual (PIM), including clearly defined responsibilities of various implementing agencies for the whole procurement cycle management; (2) Procurement training to be provided for relevant staff of the implementing agencies.

The overall procurement risk of the proposed is considered **average**.

C. Procurement Plan

The PIU, at appraisal, developed a procurement plan for project implementation which provides the basis for the procurement methods and time frame of the implementation. This Procurement Plan dated May 23, 2006 has been agreed with the Bank's task team and is available at the PIU at Khan-Uul District, Chinggis Avenue, P.O.Box 479, 210136 Ulaanbaatar, Mongolia, Tel: +976-11-342691, Fax: +976-11-342377. It will also be available in the project's database and in the Bank's external website. The Procurement Plan will be updated in agreement with the Bank's task team at least annually or as required to reflect the project implementation needs and improvements in institutional capacity.

D. Frequency of Procurement Supervision

In addition to the prior review supervision to be carried out from the Bank's offices, the capacity assessment of the implementing agencies has recommended a launch workshop and one supervision mission to visit the field to carry out post review of procurement actions for every six to eight months.

E. Details of the Procurement Arrangements

Procurement Method		Threshold	Prior Review Threshold
Goods	ICB	≥US$100,000	All ICB contracts
	Shopping	<US$100,000	The first three contracts
	Direct contracting	Contracts for goods meeting the requirements of article 3.6 of the Procurement Guidelines.	All contracts regardless of their values
Consulting Services [1/]	QCBS	≥US$100,000	All QCBS contracts
	QBS	Assignments which meet Para. 3.2 of the Consultant Guidelines.	All QBS contracts
	CQS	<US$100,000	The first three contracts
	LCS	All assignments for auditing PMU accounts	All contracts regardless of their values
	IC	Assignments meeting the requirements of Para. 5.1 and 5.3 of the Consultant Guidelines	All contracts ≥US$50,000

Notes: 1) Short lists composed entirely of national consultants: Short lists of consultants for services estimated to cost less than USD 100,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

Annex 9: Economic and Financial Analysis

MONGOLIA: Renewable Energy and Rural Electricity Access Project

1. Herders' Electricity Access

The cost-effectiveness of meeting the most basic lighting needs of non-electrified herder households with alternative light sources was analyzed, including candles, kerosene lamps, and SHSs. There is no systematic information about how herders use their lighting. An interesting aspect of the herder households is that all their school aged children live in soum centers during school year. So the lighting use for reading in the gers could be low compared to households with permanent residence. Since the lighting quality of alternative light sources is very different, the cost-effectiveness analysis compares the cost of equal lighting output measured in dollar per thousand lumen hours ($/klh).

The estimated cost per klh light output of candles, kerosene lamps, and a 20Wp SHS with two 8W CFLs are $7.5, $0.47, and $0.04, respectively. There is a clear cost advantage for SHSs on the basis of equivalent lighting provided. The analytical process for obtaining the cost estimates is depicted in the table below.

	Candles	**Hurricane Kerosene Lamp**	**2x8W CFLs of a 20Wp SHS**
Service Life	2.5 hrs per candle	400 hrs per wick	3000 hrs per lamp
Consumption/replacement	365 sticks per year	40 liters of kerosene per yr 4 pieces of wicks per year 1 lamp every 5 years	2 lamps every 2 years 1 battery every 2 years 1 PV module every 20 yrs
Light output (lumens)	8	45	45 per W
Daily usage	2.5 hrs	4 hrs	4 hrs
Annual service provided	7,300 lumen hours	65,700 lumen hours	1,051,200 lumen hours
First Cost **Recurrent cost**	$0.15 per stick $0.15 per stick	$3 for lamp $0.65/liter-kerosene $1 per wick	$160 for a complete system $50 for a battery $3 for a lamp
Annualized cost (over a 20-year period)	$55	$31	$42
Discount rate	12%	12%	12%
Cost per unit of service	$7.53/klh	$0.47/klh	$0.04/klh

A large baseline study of electrification for herder households was jointly conducted in 2003 by the Governments of Mongolia and Japan. It revealed that there was a high desire for electricity service among herders, about two thirds of them want to buy SHSs, and most of them preferred 50Wp or larger SHSs so they could watch TV. However, the study also revealed that about 40% of the herder households had declared annual cash income of US$450 or less, about 30% had annual income between $450 and $880, and another 30% had $880 or more. Thus even a $160 basic 20Wp SHS system would be out of reach of the bottom 40% of the herder households. The retail price of a good quality 50Wp system (able to provide for about 6 hours of lighting and 3 hours of black and white TV watching) is about $400, which would be too expensive even for a well-off household with $880 annual cash income. The government's rural electrification strategy not only stress the importance of providing for basic lighting service, but also the additional benefits of promoting rural information and communications programs. Acquiring a 50Wp or larger system opens up doors for such activities. To help herder households of different

income levels to maximize the benefits of electrification, it is proposed that subsidies will be provided to first-time purchase of 20-100Wp systems regardless of income levels.

The proposed subsidy for 20-49Wp systems is $80, which would cover 50% of the cost of a good quality 20Wp system. This subsidy is intended for poor herder households which can only afford to borrow very small sums (in fact borrowing at current high interest rates of some 30% APR is not recommendable to the poor) and will enable them to purchase a basic SHS for lighting purpose with about $30 of micro-credit, which can be paid back in a year with their normal lighting expenditure (on candles). The financing structure in this situation would be: $80 subsidy, $50 out of pocket payment (what they spend on candles per year), and $30 micro credit.

The proposed subsidy for 50-100Wp system is $160 and would cover 40% of the cost of a good quality 50Wp system. This subsidy level was proposed by GoM based on the aforementioned baseline survey study. It was concluded that to achieve maximum saturation of SHSs (then targeted at 100,000 herder households), the cost of the system (50Wp) has to be brought down by 50%. This proposed subsidy, at $1.6-3/Wp, is comparable to subsidy levels seen in other SHS market development programs which the World Bank has been involved with.

2. Soum Center Electricity Service

All off-grid soum centers have similar small diesel power plants equipped with two to three 60 and/or 100kW diesel power generators. Most of these soums have good-to-excellent solar energy resources (annual insolation 1400-16000 kWh/m^2), while many also have good to excellent wind energy resources (average annual wind speed 6.4-7.1 m/s at 20 meter height). There are a few soums (all located in the northern-most Khuvsgul Aimag) with only marginal wind (4.5-5.6m/s) and solar (less than 1200 kWh/m^2) energy resources.

This project will invest in renewable or renewable-diesel hybrid generation systems at soum centers with good-to-excellent conditions for exploiting wind or solar energy. Since these systems will be similar in configuration, a typical soum center where conditions for utilization of either wind or solar energy are good is chosen as a benchmark case for evaluating the cost-effectiveness of supply options which may or may not use renewable energy sources.

2.1 Methodology

A micro-power optimization model, HOMER, developed by the National Renewable Energy Laboratory (USA)[15], was used to analyze the options and calculate the levelized cost of electricity (COE) of different system configurations.

In theory, levelized cost of electricity is calculated by the following formula:

$$COE = NPV * CRF / AES$$

Where NPV is the total net present value of the complete system costs, including initial capital investment, operation and maintenance, CRF is the capital recovery factor (which is determined

[15] The software is available from the website: www.NREL.gov

by discount rate and is applied to obtain the annualized and equal cost), and AES is annual electricity supply (system load).

2.2 Conclusions

At 12% real discount rate, the levelized cost of electricity (COE) over 20 years is $0.39/kWh for the wind-diesel (with battery bank) hybrid system, $0.48/kWh for the diesel-only system, and $0.80/kWh for solar-diesel (with battery bank) hybrid system. There are actually three configurations, including diesel generator plus battery bank, wind-diesel without battery bank, and solar-wind (with battery bank) hybrid system, which have lower cost than the solar-diesel (with battery bank) hybrid system.

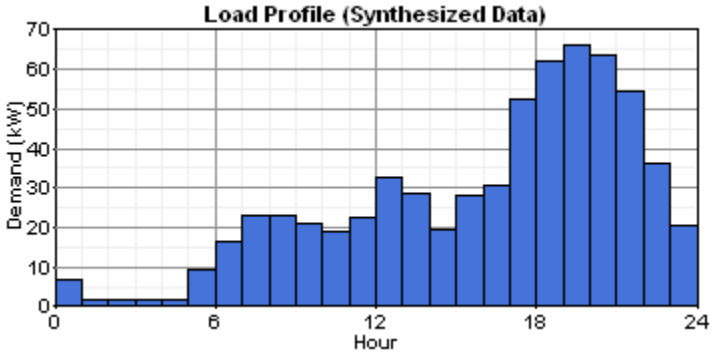
This cost-effectiveness ranking does not change if the major constraining factors, including wind speed, solar insolation, and diesel price, moves up or down by 10%.

2.3 Data Input

The main data input to run the simulation and sensitivity analysis are summarized below:

AC LOAD:

Scaled annual average: 644 kWh/d
Scaled peak load: 76.0 kW
Load factor: 0.353



PV

Size (kW)	Capital ($)	Replacement ($)	O&M ($/yr)
1.000	8,000	4,000	10

Sizes to consider: 0, 100 kW
Lifetime: 20 yr

SOLAR RESOURCE

Scaled annual average: 4.49 kWh/m2/d

DC WIND TURBINE: BWC EXCEL-R

Quantity	Capital ($)	Replacement ($)	O&M ($/yr)
1	23,000	18,000	100

Quantities to consider: 0, 10
Lifetime: 15 yr
Hub height: 30 m

WIND RESOURCE

Scaled annual average: 6.80 m/s
Anemometer height: 20 m

AC GENERATOR: GENERATOR 1

Size (kW)	Capital ($)	Replacement ($)	O&M ($/hr)
60.000	27,500	27,500	0.100
100.000	45,833	45,833	0.170

Sizes to consider: 0, 60, 100kW
Lifetime: 35,000 hrs
Min. load ratio: 30%

FUEL: Diesel Price: $ 0.90/L

BATTERY: HOPPECKE 24 OPZS 3000

Quantity	Capital ($)	Replacement ($)	O&M ($/yr)
1	1,200	1,200	3.00

Quantities to consider: 0, 50, 100, 110, 120, 130, 140, 150
Voltage: 2 V
Nominal capacity: 3,000 Ah
Lifetime throughput: 10,196 kWh

CONVERTER

Size (kW)	Capital ($)	Replacement ($)	O&M ($/yr)
1.000	1,250	1,250	5

Sizes to consider: 0, 100 kW
Lifetime: 20 yr
Inverter efficiency: 90%

ECONOMICS

Annual real interest rate: 12%
Project lifetime: 20 yr
System fixed O&M cost: $ 2,000/yr

3. Financial Analysis: Wind-Diesel (with Battery Bank) Hybrid System

For the least cost electricity supply option of wind-diesel (with battery bank) hybrid system, two business scenarios are analyzed to determine the average tariff level for a given set of cost constraints and financial objectives. Under the Partial Cost Recovery Scenario, the soum utility is required to recover operational and maintenance costs and to finance investments in future equipment replacements with revenues generated from electricity sales. Under the Full Cost Recovery Scenario, the soum utility is required to recover the initial capital investments, the operational and maintenance costs, as well as to finance investments in future equipment replacements with revenues generated from electricity sales.

The projected system load for this particular soum center under a 24-hour supply regime is 233,637 kWh per year. Salable electricity is 198,591 kWh per year after deduct for 15% line losses. The specific costs are as follows:

Component	Initial Capital	Equipment Life Cycle	Annual O&M	Annual Fuel
	($)		($/yr)	($/yr)
BWC Excel-R	230,000	15 years	1,000	NA
Generator 1	27,500	35,000 hrs	187	20,323
Battery	60,000	8 years	150	NA
Converter	125,000	20 years	500	NA
Mini-grid improvement	30,000	20 years	100	NA
Labor	NA	NA	2,000	NA
Totals	472,500	NA	3,937	20,323

3.1 Partial Cost Recovery Scenario (Project Case)

Under the partial cost recovery scenario, the initial capital investment is financed by grants (as is the case for the project), electricity sales need to pay for expenditures on operation and maintenance and finance future capital investments in equipment replacement. In the simplest case of constant costs and zero arrears the soum utility will need to charge an average electricity tariff of $0.167/kWh to obtain a financial rate of return of 12%. The soum utility's cash flows in this particular situation are depicted in the table below:

Year	Electricity Sales (kWh)	Revenue	Operating and Maintenance Cost	Pre-tax Income	Investments
0					0
1	198,591	$ 33,165	$(24,260)	$ 8,905	
2	198,591	$ 33,165	$(24,260)	$ 8,905	
3	198,591	$ 33,165	$(24,260)	$ 8,905	
4	198,591	$ 33,165	$(24,260)	$ 8,905	
5	198,591	$ 33,165	$(24,260)	$ 8,905	
6	198,591	$ 33,165	$(24,260)	$ 8,905	
7	198,591	$ 33,165	$(24,260)	$ 8,905	
8	198,591	$ 33,165	$(24,260)	$ 8,905	
9	198,591	$ 33,165	$(24,260)	$ 8,905	$ (60,000)
10	198,591	$ 33,165	$(24,260)	$ 8,905	
11	198,591	$ 33,165	$(24,260)	$ 8,905	

12	198,591	$ 33,165	$(24,260)	$ 8,905	
13	198,591	$ 33,165	$(24,260)	$ 8,905	
14	198,591	$ 33,165	$(24,260)	$ 8,905	$ (27,500)
15	198,591	$ 33,165	$(24,260)	$ 8,905	
16	198,591	$ 33,165	$(24,260)	$ 8,905	$(180,000)
17	198,591	$ 33,165	$(24,260)	$ 8,905	$ (60,000)
18	198,591	$ 33,165	$(24,260)	$ 8,905	
19	198,591	$ 33,165	$(24,260)	$ 8,905	
20	198,591	$ 33,165	$(24,260)	$ 8,905	

In comparison, the soum center currently needs to charge $0.48/kWh just to recover the fuel cost (for an annual consumption of about 46,800 kWh). At $0.17/kWh, the poorest households (annual household income < $600) in the soum center would spend about 5% of their income on basic lighting service. Survey indicates that on average households in soum centers spend 6% of their income on electricity, with a high of 12% for lowest income households (annual household income < $600) and a low of 2% for highest income households (annual income > $2000).

3.2 Full Cost Recovery Scenario

Under the full cost recovery scenario, electricity sales need to recover initial capital investment, pay for expenditures on operation and maintenance, and finance future capital investments in equipment replacement. In the simplest case of constant costs and zero arrears the soum utility will need to charge an average electricity tariff of $0.485/kWh to obtain a financial rate of return of 12%., assuming that all investments are financed by equity (the government as the equity holder). The soum utility's cash flows in this particular situation are depicted in the table below:

Year	Electricity Sales (kWh)	Revenue	Operating and Maintenance Cost	Pre-tax Income	Investments
0					$(472,500)
1	198,591	$ 96,317	$(24,260)	$ 72,057	
2	198,591	$ 96,317	$(24,260)	$ 72,057	
3	198,591	$ 96,317	$(24,260)	$ 72,057	
4	198,591	$ 96,317	$(24,260)	$ 72,057	
5	198,591	$ 96,317	$(24,260)	$ 72,057	
6	198,591	$ 96,317	$(24,260)	$ 72,057	
7	198,591	$ 96,317	$(24,260)	$ 72,057	
8	198,591	$ 96,317	$(24,260)	$ 72,057	
9	198,591	$ 96,317	$(24,260)	$ 72,057	$ (60,000)
10	198,591	$ 96,317	$(24,260)	$ 72,057	
11	198,591	$ 96,317	$(24,260)	$ 72,057	
12	198,591	$ 96,317	$(24,260)	$ 72,057	
13	198,591	$ 96,317	$(24,260)	$ 72,057	
14	198,591	$ 96,317	$(24,260)	$ 72,057	$ (27,500)
15	198,591	$ 96,317	$(24,260)	$ 72,057	
16	198,591	$ 96,317	$(24,260)	$ 72,057	$(180,000)
17	198,591	$ 96,317	$(24,260)	$ 72,057	$ (60,000)
18	198,591	$ 96,317	$(24,260)	$ 72,057	
19	198,591	$ 96,317	$(24,260)	$ 72,057	
20	198,591	$ 96,317	$(24,260)	$ 72,057	

3.3 Conclusions

By providing grants for initial capital investments, the project in effect subsidies for soum center electricity supply at an amount of $0.32/kWh (=$0.485/kWh - $0.167/kWh). Under the partial cost recovery scenario, the average tariff of $0.17/kWh will be much more affordable than the current diesel-only generation and the soum utility's financial sustainability will be robust.

Annex 10: Safeguard Policy Issues

MONGOLIA: Renewable Energy and Rural Electricity Access Project

The project is rated Category C.

The project will implement a battery management program as part of the retail network development. This program will become effective by the time of mid-term review.

The project will conduct its marketing and information campaign with due diligence to ensure that all herders will have equal access to information and the retail market which the project seek to develop. In regions/areas where Mongolian is not the first language, both the local first language and Mongolian will be used in marketing and information campaign materials and venues.

Annex 11: Project Preparation and Supervision

MONGOLIA: Renewable Energy and Rural Electricity Access Project

	Planned	Actual
PCN review		February 16, 2006
Initial PID to PIC		July 20, 2006
Initial ISDS to PIC		September 5, 2006
Appraisal	August 25, 2006	October 15, 2006
Negotiations	October 10, 2006	November 15, 2006
Board/RVP approval	December 12, 2006	
Planned date of effectiveness	March 31, 2007	
Planned date of mid-term review	November 30, 2008	
Planned closing date	December 31, 2011	

Key institutions responsible for preparation of the project:
National Renewable Energy Center of Mongolia

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Salvador Rivera	Senior Energy Specialist / Task team leader	EASEG
Orogdol Sanjaasuren	Operations Officer	EASUR
Feng Liu	Consultant / Economist	EASEG
Chrisantha Ratnayake	Consultant / RET Specialist	EASEG
Robert Van derPlas	Consultant / RET Specialist	EASEG
Nikhil Desai	Consultant/Energy Economist	NA
Enno Heijndermans	Consultant / RET Specialist	EASEG
Nickhil Desai	Consultant / RET Specialist	EASEG
Robert Cater	Consultant/Financial Systems	NA
Carlos Escudero	Lead Counsel	LEGEA
Martin Serrano	Lawyer	LEGEA
Haixia Li	Financial Management Specialist	EAPCO
Xiaoping Li	Senior Procurement Specialist	EAPCO
Gerelgua Tserendagva	Procurement Analyst	EAPCO
Carla Sarmiento	Program Assistant	EASEG

Bank funds expended to date on project preparation:
1. Bank resources: US$91,224.18
2. Trust funds: US$220,420.73
3. Total: US$311,645

Estimated Approval and Supervision costs:
1. Remaining costs to approval: $30,000
2. Estimated annual supervision cost: $ 65,000

Annex 12: Agreement Reached with MOFE during Negotiations

MONGOLIA: Renewable Energy and Rural Electricity Access Project

1. The Recipient will:
   - within the Ministry of Fuel and Energy, and thereafter maintain throughout the period of implementation of the Project, a Project Steering Committee with representation from, *inter alia*, the National Renewable Energy Center, the Ministry of Fuel and Energy and the Ministry of Finance.
   - promptly transfer to NREC, in a manner satisfactory to the Association, the total amount required to cover the portion of Project expenditures to be financed by the Recipient during the Fiscal Year covered by each Annual Work Program prepared by NREC.
   - undertake that any and all procurement and commercialization of SPV and SWT Systems, by either the Recipient or NREC to be financed out of the Recipient's and NREC's own resources after October 17, 2006 will be carried out through competitive, transparent, economic and efficient processes acceptable to the Association.
   - will cause NREC to (i), commercialize all SPV and SWT Systems procured by the Recipient or the Project Implementing Entity pursuant to Section I.B.3 above, through (A) the selected SPV and SWT System vendors participating in the Project and (B) the Sales and Service Centers established under the Project; and (ii) collect and administer the proceeds of these sales through the Subsidy Account for the payment of sales incentives under Part A.1(ii) of the Project, exclusively.
   - undertake to use any additional funds that will be committed by the Recipient from time to time to fund activities similar to those under the Project, in particular SPV and SWT Systems, in a manner and substance acceptable to the Association and compatible with the objectives of the Project.

2. The Recipient, through MOFE, will:

   - Establish and maintain the Project Implementation Unit (PIU) within NREC, including a Project Executive Director, two Operation Officers, an Operation Assistant, a Financial Officer, an Accountant and a Procurement Officer, all of them with terms of reference satisfactory to the Association..
   - select, by no later than December 31, 2007, and thereafter retain throughout the implementation of the Project, an independent auditor acceptable to the Association, to carry out the annual audits of all Project accounts (including the Subsidy Account) and Financial Statements.
   - prepare, adopt and apply throughout the implementation of the Project, a Project Implementation Manual satisfactory to the Association.
   - furnish to the Association for approval: (i) an Annual Work Program identifying Project activities by component and sub-component, and their related expenditures and financing sources, to be carried out during for Fiscal Year 2007; and (ii) by October 31 of each year, commencing on October 31, 2007, Annual Work Programs identifying Project activities by component and sub-component, and their related

expenditures and financing sources, to be carried out during the following Fiscal Year;

- with regard to the Smart Subsidy Program , the Recipient will:
    - open and maintain, with its own resources, a [United States Dollars/Togrog] denominated, account in a commercial bank under terms and conditions satisfactory to the Association
    - collect into, and administer through, the Subsidy Account the proceeds of the sales at wholesale prices of the SPV and SWT Systems directly procured by the Recipient and/or the NREC;
    - use the funds available in the Subsidy Account exclusively for the payment of the sales incentives under Part A.1(ii) of the Project, upon the sale and delivery to herders (as evidenced in the Sales Report) of the respective SPV and SWT Systems; and
    - deposits into, and payments out of, the Subsidy Account shall be made in accordance with the provisions of the Financial Management Manual.
- the Recipient will select private partners for the establishment of SSCs and enter into partnership arrangements with the said partners, pursuant to the provisions of the Project Implementation Manual;
- select vendors of SPV and SWT Systems, and enter into sales arrangements with the said vendors, as provided for in the Project Implementation Manual, setting forth the structure of the flat sales incentives, including (i) the agreed Price Subsidy Levels per herder household, per validated SPV and SWT System sold and delivered, and (ii) the minimum quality standards and consumers warranties applicable to SPV and SWT Systems to be offered;
- design, prepare and, thereafter, regularly update a sales catalog of validated SPV and SWT Systems eligible for the sales incentives under the Smart Subsidy Program, pursuant to the provisions of the Project Implementation Manual and the sales arrangements entered with the respective vendors.
- certify to the Association and the Bank , on a quarterly basis, through Sales Reports satisfactory to the Association and the Bank filed with the Association and the Bank no later than fifteen (15) days after the end of each calendar quarter therein covered:

    (i) that the vendors and SSCs have sold and delivered all the SPV and SWT Systems for which sales incentives have been paid;

    (ii) that, at the date of each such payments, the respective vendors had performed, and were in compliance with, their respective obligations under the partnership and sales arrangements; and

    (iii) the number of SPV and SWT Systems sold and delivered, classified by SSCs, vendor and system cataloged, including a detail of vendors' purchases and sales during the quarter covered by each Sales Report, and their stocks of SPV and SWT Systems at the beginning and the end of each such quarter.

- the Recipient will (a) by no later than December 31, 2007, provide to the Association a detail battery management program setting forth the strategy for recovering and treating

the used batteries of SPV and SWT Systems; and (b) thereafter, implement said program, giving due consideration to the Bank and Association's view thereon.

- select approximately thirty (30) off-grid Soum centers, in accordance with the Project Implementation Manual and their expressed written commitment to the provision of electricity service under sound economic practices, for the rehabilitation of their mini-grids; and select, in accordance with the Project Implementation Manual, approximately twenty (20) out of the aforementioned thirty (30) Soum centers, and enter into memoranda of understanding with the respective Soums agencies, as provided for in the Project Implementation Manual, for the provision of renewable or renewable-diesel hybrid generation systems to restructured electricity service utilities.
- monitor and evaluate the progress of the Project and prepare annual Project Reports on the basis of the performance indicators.
- prepare, by no later than January 31, April 30, July 31 and October 31 of each year, simplified quarterly Project Reports, covering the Project activities of the preceding calendar quarter, and soon thereafter furnish each such report to the Association
- The performance indicators referred to above in sub-paragraph (a) consist of the following:
    - (i) about 50,000 SPV or SWT Systems sold to herders by December 31, 2011;
    - (ii) about 200,000 herders (including their families) benefiting from first electricity access or improved electricity services by December 31, 2011;
    - (iii) about thirty (30) Soum grids rehabilitated with improved tariff and billing systems and functioning Soum utilities and electricity user associations by December 31, 2011;
    - (iv) about twenty (20) power systems with renewable diesel hybrid generation installed in selected Soums by December 31, 2011; and
    - (v) about 16,000 people in selected Soum centers benefiting from improved electricity services by December 31, 2011.

Annex 13: Documents in the Project File

MONGOLIA: Renewable Energy and Rural Electricity Access Project

1. Consultative OOPP workshop proceedings, 08/20/2005
2. Renewable Energy Conference Summary, 10/30/2005
3. Project Concept Note, 02/16/2006
4. Terms of Reference for Wind-Diesel Hybrid System Configurations, 04/10/2006
5. Terms of Reference for Establishment of Soum Center Users' Association, 04/10/2006
6. Terms of Reference for Development of Soum Center Utilities, 04/10/2006
7. Draft Project Implementation Plan, 04/11/2006, 06/14/2006
8. Mandakh Soum Center Electricity Use Survey Report, 04/28/2006
9. Feasibility Study of Wind-diesel Hybrid System Investment in Mandakh Soum Center, 04/28/2006
10. Off-grid Soum Center Baseline Study Report, 04/28/2006
11. Herders Electricity Access Baseline Study Report, 04/28/2006
12. Survey Report of Non-electricity Lighting Expenditure in Aimag and Soum Centers, 05/18/2006
13. First Year Work Plan, 06/14/2006, 09/06/2006
14. Consultant Report on Establishment of Soum Center Users' Association, 07/11/2006
15. Consultant Report on Development of Soum Center Utilities, 07/11/2006
16. Survey Report on Zereg and Sevrei Soum Centers, 07/11/2006
17. Letter from Minister of Fuel and Energy Regarding Renewable Energy and Rural Electrification Project, 07/18/2006
18. Feasibility Study of Wind-diesel Hybrid System Investment in Sevrei Soum Center, 07/24/2006
19. Feasibility Study of Renewable or renewable-diesel Hybrid System Investment in Bogd Soum Center, 07/26/2006
20. Instructions for Establishing Soum Electricity Users Association, consultant report, 10/05/2006
21. Letter from Minister of Fuel and Energy on Renewable Energy and Rural Electricity Project, 10/17/2006
22. Consultant Report: Manual for Soum Center Utility Establishment, 11/08/2006
23. Japan External Trade Organization Feasibility Study on Provision of Solar Home Systems to 100,000 Herder Households, March 2003
24. Mongolia Country Report on Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement (ADB Administered), December 2004
25. Mission Aide Memoires, various dates

Annex 14: Statement of Loans and Credits

MONGOLIA: Renewable Energy and Rural Electricity Access Project

			Original Amount in US$ Millions						Difference between expected and actual disbursements	
Project ID	FY	Purpose	IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P088816	2005	MN-Index-Based Livestock Insurance	0.00	7.75	0.00	0.00	0.00	7.05	0.14	0.00
P088992	2005	MN-Private Sector Development Credit II	0.00	10.57	0.00	0.00	0.00	10.12	0.20	0.00
P074591	2004	MN-UB SERVICES IMPROVMT 2	0.00	18.00	0.00	0.00	0.00	16.57	0.99	0.00
P077778	2003	MN Economic Capacity Tech. Assistance	0.00	7.50	0.00	0.00	0.00	5.64	3.87	0.00
P067770	2002	MN - Sustainable Livelihoods Project	0.00	18.73	0.00	0.00	0.00	6.53	3.36	0.00
P071023	2002	MN-Financial Capacity Dev. Project	0.00	5.00	0.00	0.00	0.00	2.17	1.30	0.00
P074001	2002	MN-Mongolia Legal Reform	0.00	5.00	0.00	0.00	0.00	2.17	1.35	0.00
P056200	2001	MN-Transport Development	0.00	34.00	0.00	0.00	0.00	6.42	3.32	0.00
P040907	2001	MN-Energy Sector	0.00	30.00	0.00	0.00	0.00	19.15	13.97	20.22
		Total:	0.00	136.55	0.00	0.00	0.00	75.82	28.50	20.22

MONGOLIA
STATEMENT OF IFC's
Held and Disbursed Portfolio
In Millions of US Dollars

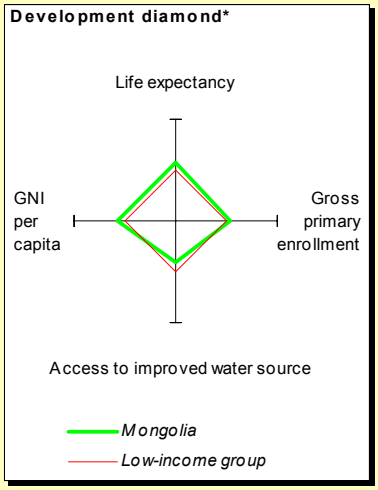
		Committed				**Disbursed**			
		IFC				**IFC**			
FY Approval	Company	Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2004	AgBank	0.00	1.17	0.00	0.00	0.00	1.17	0.00	0.00
2001	SEF XACBank	0.36	0.00	0.00	0.00	0.36	0.00	0.00	0.00
2004	TDB	0.00	0.00	4.89	0.00	0.00	0.00	4.89	0.00
	Total portfilio:	0.36	1.17	4.89	0.00	0.36	1.17	4.89	0.00

		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic.
	Total pending committment:	0.00	0.00	0.00	0.00

Annex 15: Country at a Glance

MONGOLIA: Renewable Energy and Rural Electricity Access Project

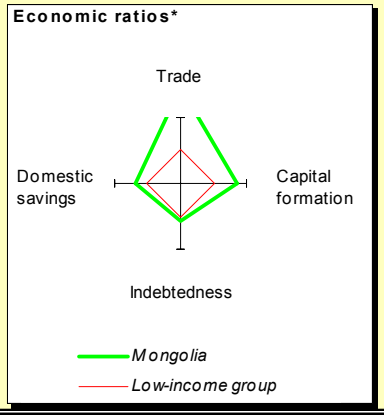
POVERTY and SOCIAL	Mongolia	East Asia & Pacific	Low-income
2004			
Population, mid-year *(millions)*	2.5	1,870	2,338
GNI per capita *(Atlas method, US$)*	590	1,280	510
GNI *(Atlas method, US$ billions)*	1.5	2,389	1,184
Average annual growth, 1998-04			
Population *(%)*	1.1	0.9	1.8
Labor force *(%)*	2.3	1.1	2.1
Most recent estimate (latest year available, 1998-04)			
Poverty *(% of population below national poverty line)*	36	..	..
Urban population *(% of total population)*	57	41	31
Life expectancy at birth *(years)*	66	70	58
Infant mortality *(per 1,000 live births)*	56	32	79
Child malnutrition *(% of children under 5)*	13	15	44
Access to an improved water source *(% of population)*	62	78	75
Literacy *(% of population age 15+)*	98	90	61
Gross primary enrollment *(% of school-age population)*	101	113	94
Male	100	113	101
Female	102	112	88



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

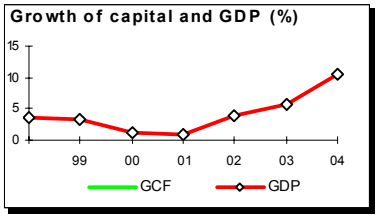
	1984	1994	2003	2004
GDP *(US$ billions)*	..	0.64	1.3	1.5
Gross capital formation/GDP	57.8	27.6	38.0	38.0
Exports of goods and services/GDP	29.2	64.5	49.2	55.9
Gross domestic savings/GDP	..	13.3	22.4	27.7
Gross national savings/GDP	..	21.9	34.2	45.0
Current account balance/GDP	..	5.9	-7.8	-2.5
Interest payments/GDP	..	1.5	0.9	0.9
Total debt/GDP	..	72.5	115.5	107.0
Total debt service/exports	..	10.9	33.5	2.5
Present value of debt/GDP	..	..	85.9	..
Present value of debt/exports	..	..	127.4	..

	1984-94	1994-04	2003	2004	2004-08
(average annual growth)					
GDP	-0.3	2.0	5.6	10.6	..
GDP per capita	-2.1	0.9	4.3	9.1	..

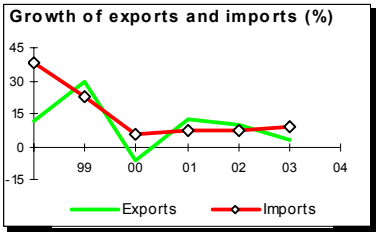


STRUCTURE of the ECONOMY

	1984	1994	2003	2004
(% of GDP)				
Agriculture	17.2	42.2	20.1	21.3
Industry	27.0	24.5	25.3	28.2
Manufacturing	..	..	6.2	5.3
Services	55.8	33.3	54.6	50.5
Household final consumption expenditure	..	67.1	57.6	53.2
General gov't final consumption expenditure	..	19.6	20.0	19.1
Imports of goods and services	65.1	78.8	64.9	66.3

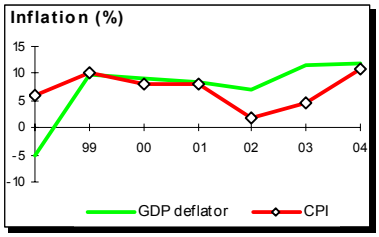


	1984-94	1994-04	2003	2004
(average annual growth)				
Agriculture	-0.9	-3.3	5.8	18.9
Industry	-2.0	4.1	3.0	15.4
Manufacturing	..	4.0	2.1	1.5
Services	1.2	5.0	7.1	4.0
Household final consumption expenditure	..	..	..	..
General gov't final consumption expenditure	..	..	..	..
Gross capital formation	..	..	..	..
Imports of goods and services	..	19.3	9.2	..



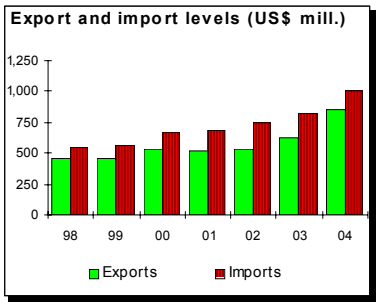
PRICES and GOVERNMENT FINANCE

	1984	1994	2003	2004
Domestic prices				
(% change)				
Consumer prices	..	66.3	4.6	11.0
Implicit GDP deflator	-3.1	66.6	11.5	11.9
Government finance				
(% of GDP, includes current grants)				
Current revenue	55.8	32.3	37.9	39.4
Current budget balance	2.5	5.0	8.1	10.3
Overall surplus/deficit	..	5.3	-4.2	0.0



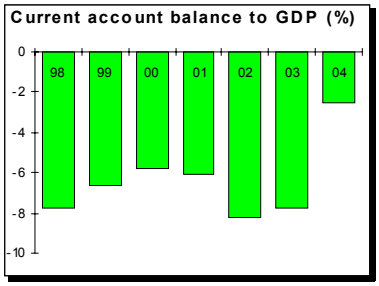
TRADE

	1984	1994	2003	2004
(US$ millions)				
Total exports (fob)	..	367	627	853
Copper	..	189	165	284
Non-monetized gold	..	11	157	240
Manufactures	..	64	232	231
Total imports (cif)	..	370	827	1,012
Food	..	20	116	157
Fuel and energy	..	75	174	231
Capital goods	..	93	265	305
Export price index *(2000=100)*	..	..	..	..
Import price index *(2000=100)*	..	..	..	..
Terms of trade *(2000=100)*	..	..	..	..



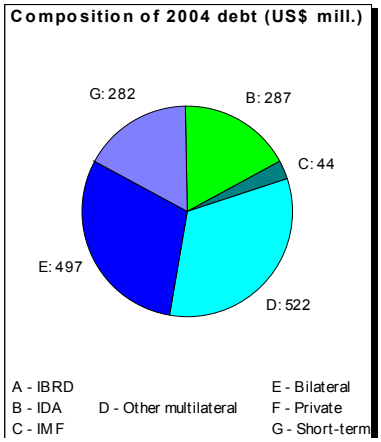
BALANCE of PAYMENTS

	1984	1994	2003	2004
(US$ millions)				
Exports of goods and services	650	407	835	1,192
Imports of goods and services	1,351	425	1,084	1,494
Resource balance	-701	-18	-249	-303
Net income	-39	-19	-12	-11
Net current transfers	0	75	162	275
Current account balance	-740	38	-99	-38
Financing items (net)	756	-44	153	73
Changes in net reserves	-16	6	-54	-35
Memo:				
Reserves including gold *(US$ millions)*	..	37	129	..
Conversion rate *(DEC, local/US$)*	..	412.7	1,146.5	1,185.3



EXTERNAL DEBT and RESOURCE FLOWS

	1984	1994	2003	2004
(US$ millions)				
Total debt outstanding and disbursed	..	464	1,472	1,632
IBRD	..	0	0	0
IDA	..	49	227	287
Total debt service	..	45	288	34
IBRD	..	0	0	0
IDA	..	0	2	4
Composition of net resource flows				
Official grants	..	62	67	..
Official creditors	..	64	-154	115
Private creditors	..	-22	0	0
Foreign direct investment (net inflows)	..	7	132	..
Portfolio equity (net inflows)	..	0	0	..
World Bank program				
Commitments	..	30	8	18
Disbursements	..	17	29	49
Principal repayments	..	0	1	2



Annex 16: Incremental Cost Analysis

MONGOLIA: Renewable Energy and Rural Electricity Access Project

Rural electrification and renewable energy technologies in Mongolia

Mongolia is a low-income country in transition. The move toward a market-based economy over the last decade or so has brought about macroeconomic stability and steady economic growth. However, disparities of incomes and access to, and benefits from, publicly provided services have increased between urban and rural areas. Equitable, broad-based poverty reduction requires attention to growth bottlenecks in the rural areas, where about 40% of the population resides.

Access to electricity is a key indicator of rural development. While over 90% of the urban population is served by relatively reliable national and regional power grids, only 40% of the rural households have access to electricity supply provided mostly through stand-alone diesel generators. Without access to electricity, rural living standards are limited by low agricultural and livestock productivity and very few opportunities for non-farm employment or other value-adding economic activities.

The rural electricity market serves about one million people. About 60% of them are nomadic herders and the rest resides in 314 soum centers, which are rural hubs for public and commercial services. The only electrification option for herders is small stand-alone systems. There are 117 soum centers which are connected to national or regional power grids. The rest have diesel-based micro-grids which have a poor record of supply reliability. Solar home systems (SHSs) and small wind turbines (Small WTSs) are consider most appropriate electricity supply technologies for the herders. There are also large potential to exploit renewable energy for soum center electricity services through hybrid systems of diesel generator and site-specific renewable energy technologies (RETs).

The performance and sustainability of diesel-based soum center electricity service are undermined by (i) antiquated distribution networks resulting in high losses, and (ii) virtual absence of a rational tariff and billing system to encourage efficient use, loss reduction, proper management practices, or provide for growth and exploration of RETs.

The herders are the least electrified population group in Mongolia. Unlike rural populations in many other developing countries, the awareness of SHSs and Small WTSs for individual use is relatively high in Mongolia. About 40,000 solar home systems (SHS) and 3,000 wind turbine systems have been sold, many with heavy and poorly targeted government subsidy and without systematic attention to quality of products or after-sales service.

With the unelectrified and poorly electrified populations sparsely distributed over vast terrains, the GoM recognized that grid connection is economically justifiable for only a portion of the soum centers. The remaining soum centers will remain dependent on high-cost diesel generators that provide unreliable supplies. And the herding community will remain beyond reach of grid electricity altogether.

Mongolia is richly endowed with solar and wind energy resources. Solar insolation is reported to be about 4.5 kWh/m^2 on daily average and 1,400 kWh/m^2 on annual average basis. The Gobi desert and plain zones are estimated to have a technical potential of more than 800 billion kWh/year of wind electricity, with average usable time of between 3,500 to 4,600 hours per year.

A variety of experimental, research, or demonstration projects and programs have been implemented by the government and donor agencies over the past 15 years or so. Markets for standalone solar PV and wind power systems have established a foothold. However, the supply chains have remained essentially based in Ulaanbaatar City, quality standards are weak, as is after-sales maintenance and services.

The Government has the following goals in rural electrification:

- Provide power to all remote soums and settlements that cannot economically be connected to national or regional power grids, by the introduction of renewable energy systems. The mid term objectives (2010) are to electrify at least 8 remote soum centers by wind-diesel or wind-solar-diesel hybrid power stations, and electrify at least 5 soum centers using solar-diesel hybrid systems.
- Develop and implement step by step sub-programs to expand application of solar and wind energy for productive uses.
- Supply all herding households in rural area with renewable energy sources. The number of herder households is estimated at about 150,000. About 70-80% of them still has no access to electricity.

Barriers to increasing rural electricity access and service quality

Renewable energy development in Mongolia still is in its fledgling phase and will need strong policy support to reach a self-sustaining level. The specific barriers include

(a) FOR NORMADIC HERDERS

(i) Highly dispersed nature of nomadic herders, limitations in information and awareness and the difficulty for the private sector to carry out an effective sales program: While the only viable electricity supply option to the nomadic herders is by renewable energy, their wide dispersal and limited knowledge has suppressed the demand for individual home systems. The private sector showed interest in the past, some limited sales of SHSs and Small WTSs have taken place but these initiatives broke down when the government introduced a program to make SHS supplies through donor supplied equipment without an overall program for developing sustainable markets.

(ii) Poor quality systems made to herders in the past and lack of after sales services: There are herders who have purchased systems but have been unsatisfied with the quality of the products. This has led to bad publicity for these systems. There has been no attempt by the government to assist the setup of soum center-based maintenance and service facilities for SHSs and Small WTSs, while private dealers are content to do business just in Ulaanbaatar. Consumer education on the usage and the merits of these systems has been neglected, too.

(iii) Financing difficulties for the associated high first costs: Both SHSs and Small WTSs have high first costs and low recurrent costs. While some herders (with larger livestock ownership) can afford outright purchase, some are unable to come up with the funds required for the purchase of a suitable system. Rural financial institutions are not familiar with renewable energy equipment and have not engaged herders on viable micro-financing schemes for acquiring SHSs and Small WTSs.

(b) FOR SOUM CENTER ELECTRICITY SERVICE

(iv) Lack of a favorable policy environment for public-private partnerships in off-grid soum center electricity service provision: Soum center electricity supply is primarily for public institutions and the families of their employees. Such service used to be provided free of charge by the national government. After the collapse of this Soviet system, the soum centers are left alone to fend for themselves with no support being provided on how to manage, maintain and repair these small power systems efficiently. Tariff setting is arbitrary and inconsistent with the financial needs to sustain the operation. Bill collection is sporadic and without rational basis (no metering). These conditions are not inductive to private sector participation and will not be able to support the introduction of renewable or renewable-diesel hybrid systems.

(v) High first costs for renewable energy supplies to off-grid soum centers: While renewable energy supplies by solar PV arrays, wind turbines or small hydro plants are viable to supply the off-grid soum centers the option has not being pursued (except for a few instances where donor funding was provided) due to high first costs involved.

(c) NATIONAL RENEWABLE ENERGY DEVELOPMENT CAPACITY

(vi) There has been an institutional and regulatory vacuum in the government, as the economy moved from a socialist to a market-based system, inhibiting development of sound policies and programs and provision of effective government support, for examples, in development of regulations for grid-connected RET applications, private sector supply chains in RET equipment and service, the management of off-grid soum electricity systems, and in implementation of projects, with undue dependence on external grant finance, subject to grant donor preferences.

The baseline

In the baseline scenario, the above barriers will not be removed, and consequently the government's goals in promoting rural electricity access and service improvements will not be met. The result will be, for the herders, stagnation of electricity access and uneven quality and high life-cycle costs of retail PV/wind systems, and, for off-grid soum center electricity supply, continued deterioration in the quality of capital equipment and electricity service quality, without possibility to exploit the economic potential of renewable energy technologies. On the broad renewable energy development agenda, research and development activities will continue to be more technology-based rather than market-linked, external donor support will have limited effectiveness, and economically and environmentally responsible investment and operational decisions will not be carried out.

GEF alternative (the project)

Under the GEF alternative scenario, an integrated technical assistance and investment support package will remove the key barriers and enabling broad-based renewable energy development in Mongolia, with greater public and private resources support. More specifically, for the herders, steady and sustained expansion of the SHS and SMALL WTS markets, including the market for after sales services, and for off-grid soum center electricity supply, the emergence of a reformed market structure and operating practice, facilitating introduction of renewable energy based generation.

Project components and GEF barrier-removal activities

The following table summarizes the rationale for and the design of the project components and the role of GEF in barrier removal activities.

Baseline	GEF Alternative	Barrier Removal
1. Stagnation of retail market for PV/wind system • Continuation of the current modest-scale programs and autonomous market activity, but market growth unpredictable with high risk of 'boom and bust' cycle for local businesses because of the lack of standards, or non-compliance, for equipment and after-sales services; and poorly targeted, haphazard subsidies to end-users depending on availability of external donor funds. • Some commercial bank interest in financing PV systems, but hesitation because of doubts about product quality, consumer satisfaction, and reliability of the dealers. • Supply chains for equipment and information will not develop efficiently and competitively, and learning from successful programs in the region (e.g., Inner Mongolia and other northwestern provinces of China) will be limited. This will lead to, on average, low quality and high life-cycle costs of retail PV/wind systems, and market stagnation.	**Component A: Herders Electricity Access** • **Development of a retail network and introduction of a smart subsidy program** Assistance will be provided to certified private dealers (normally based in Ulaanbaatar) to establish a network of Aimag and/or Soum-level Renewable Power Sales and Service Centers (SSCs in short). The project will provide technical training, business planning assistance, as well as marketing support to promote sales of certified SHSs and small WTSs through this network. NREC will also develop procedures to monitor compliance with standards, trends in the quality of equipment and service, and trends in market size and composition. A smart subsidy program will be developed to assist herder households acquire SHSs/Small WTSs while also providing an output-based incentive to Dealers and their SSCs for sales of certified systems. • **Quality standards and control** NREC will adopt equipment technical standards and warrantee/service criteria to be incorporated in agreements with equipment dealers. • **Marketing and sales/service support**	GEF support will • Remove barrier number (i) by supporting private sector delivery, creating an enabling environment to provide information on the availability, costs, quality and appropriateness of the systems • Remove barrier number (ii) by developing quality assurance standards and warranties and ensuring that traders who participate in the program will only sell products which satisfy these standards and warranties. • Remove barrier number (iii) by supporting sales incentive program designed with the objectives of encouraging existing rural goods and service network to expand the market for SHSs/Small WTSs and commercial banks to scale-up their lines of credit and customer deposit schemes. Consumers will be engaged in the subsequent monitoring and evaluation of the program. The removal of these barriers will lead to • Emergence of a robust rural retail network for sales and service of SHSs and Small

	The SSCs will propagate the use of individual home systems by a well organized awareness program and equipment catalog supported by the project. The selection of the equipment will be facilitated by the catalogue of certified products and prices pre-arranged with equipment suppliers. • **Social consultations and outreach** NREC will conduct community consultations, alone or in coordination with PV/wind system vendors and banks, to gauge consumer acceptance of PV/wind electricity systems, perceptions of vendor quality, and benefits of electricity access. • **Pro-poor smart subsidies:** GEF will support the design of an incentive program to expand the market for SHSs and Small WTSs through a flat per system subsidy with most of it used to buy down the cost of equipment acquisition and a small portion of it to encourage increased sales at SSCs. The funding for this program will be provided by Dutch Government and GoM.	WTSs, and a cadre of certified dealers that can competitively maintain high standards of equipment. • Greater consumer confidence in buying PV/wind systems and arranging for maintenance and service during warranty periods and afterwards. • Market transformed towards better quality products and services, and great depth (variety of systems, service to wider geographic/economic strata). The overall result will be steady and sustained expansion of the market, including market for after-sales services.
2. Inefficient and unreliable electricity service at off-grid soum centers • Continuation of the historical practices of not metering households combined with fixed-fee monthly tariffs, few hours per day of service, and no incentives for more efficient electricity use; not collecting enough revenues to meet high fuel costs or financing maintenance or replacement, and unpredictable grants from government or external donors for new capital equipment. • Continuation of a 'low equilibrium trap' of low quality-high cost-low revenue-low growth because of weak management and planning capacity at the local, provincial, and central levels; and inability to exploit the economic potential of renewable energy due to unfamiliarity, limited experience, and weak supply	**Component B: Soum Centers Electricity Service** • **Policy and regulations on tariffs and billing, asset ownership and management contract** A rationalized framework for tariff-setting, metering, billing, and revenue management, with clear principles on operation and maintenance cost recovery and capital depreciation allowance. Formulation of new/revised legislation to open soum center mini grids for private-sector participation. Preparation of corresponding contracts. • **Soum center capacity building** Creation of soum center electricity users association and soum utilities to enhance community involvement and improve financial and operational management • **Feasibility studies** Preparation of technical	GEF support will • Remove barrier number (iv) by enabling private management (or ownership) and improvement of the soum center utilities, establishing appropriate tariff and billing regimes to make the operations sustainable. • Remove barrier number (v) by assisting development of cost effective and financially sustainable renewable energy options and piloting appropriate technical and business models for hybrid systems. The removal of these barriers will lead to • Rational investment decisions. • Good expenditure and revenue management practices at the

chains for quality equipment and service. This will lead to continued deterioration in the quality of capital equipment, household demand will grow haphazardly, limited supplies will not be rationed via pricing signals and efficiency incentives. The economic potential of renewable energy technologies will remain unexploited.	specifications and tender documents for grid rehabilitation, generation expansion using local renewable energy (solar, wind, or micro-hydro) resources. • **Demonstration of appropriate technical models for small hybrid systems.** GEF will support the design and implementation of an initial set of hybrid systems for soum centers to demonstrate the technical feasibility and improved management structures, and help ensure the quality of the scale up program funded by other donors. • **Cross-sector (health, education) assistance** Energy management assistance to soum-level public institutions.	soum center grids, with adequate income to cover operation and maintenance costs and capital depreciation. • Reduced distribution losses and improved reliability, tariffs reflect volume of consumption and at least changes in the operating costs. • High-cost diesel generation is substituted by renewable energy generation (e.g., wind, small hydro, solar PV). • Rural public institutions do not cross-subsidize households, and have the high-quality electricity service they need for priority needs. The overall result will be a reformed market structure and operating practices at the soum micro-grid, facilitating the introduction of renewable energy based generation. The government and the local private sector will be able to plan for renewable generation in a confident manner, without fearing high technical risks or transaction costs, and the experience of 'learning by doing' will add to local capacity in building and operating renewable energy systems.
3. Inadequate national capacity to support renewable energy development • Limited capacity to plan public policy or investments, or support development of private sector supply chains in RET equipment and services, or the management of soum systems. • Limited capacity to implement projects, with undue dependence on external grant finance, subject to grant donor preferences. • Potential investors in wind farms or small hydro development are unsure of the benefits and costs due to the absence of clear government guidelines and regulations and are holding out on potential renewable business	**Component C: National Capacity Building** • **National renewable energy regulatory capacity strengthening** Review of renewable energy law and consultation process, and development of regulatory framework and/or associated subsidiary legislation for grid-connected renewable energy systems • **NREC institutional strengthening and training** Preparation of organizational plans with clear descriptions of responsibilities, authorities, and program outcomes, consistent with the GoM's renewable energy development plans and strategies. Preparation and execution of	GEF support will • Remove barrier number (vi) by development of key national policy initiatives, assisting the capacity building of NREC, and project implementation. This will lead to • Effective management of the implementation of the proposed project, and all other NREC activities financed by the Government or other donors, enabling the project to proceed in efficient manner; with timely recognition of errors and failures and appropriate ameliorations.

opportunities. This will lead to more technology-based rather than market-linked research and development activities, limiting effectiveness of external donor support and hindering development of economically and environmentally responsible investment and operational policies.	business plans in an effective manner. Corresponding technical and management training provided as needed. • **Project management, monitoring, and evaluation** Execution of project implementation plan and monitoring and evaluation procedures. Revision of procedures to accommodate lessons of experience, and establishing confidence to attract additional donor finance.	• Broad consultation to improve applicability and gain support for RETs. The overall result will be enhanced ability to attract greater public and private resources into renewable energy development in rural electrification as well as for the main grid.

Incremental costs

The incremental costs are estimated based on analyzing the needs to address the overall requirements of technical assistance and investments for removing the identified barriers and achieving the physical targets which are critical to make an impact. The following table provides a detailed account of the costs for incremental activities and GEF co-financing:

	Total Cost	GEF	IDA	Dutch Gov.	GOM
Component A: Herders Electricity Access	**11,600**	**900**	**-**	**4,000**	**6,700**
Technical Assistance	*900*	*900*	-	-	-
Sales/service network development	100	100			
Quality standards and compliance	200	200			
Marketing and sales/service support	600	600			
Investment (smart subsidies)	*10,700*	-	-	*4,000*	*6,700*
Component B: Soum Center Electricity Service	**10,090**	**2,000**	**3,290**	**2,000**	**2,800**
Technical Assistance	*900*	*600*	*290*	-	-
Soum utility policy and regulation	80	-	80		
Soum level capacity building	350	200	160		
Feasibility studies for hybrid systems	400	400	-		
Energy Management Assistance	50	-	50		
Investment	*9,200*	*1,400*	*3,000*	*2,000*	*2,800*
Renewable or renewable-diesel hybrid systems	8,300	1,400	2,100	2,000	2,800
Soum mini-grid rehabilitation	900	-	900	-	-
Component C: Institutional Capacity Building	**1,310**	**600**	**210**	**-**	**500**
Project management, M&E, and NREC institutional development	910	410	100		400
National policy and regulation	400	190	110		100
Total Project	**23,000**	**3,500**	**3,500**	**6,000**	**10,000**
Technical assistance	3,100	2,100	500	-	500
Investment	19,900	1,400	3,000	6,000	9,500

Global environmental benefits

This analysis only estimated carbon dioxide emission reductions directly resulted from the investments of the proposed project.

Based strictly on the RET investments likely to have been completed as a direct result of financing under the proposed project, CO_2 emission reductions over an assumed 20 year lifetime have been estimated at a total of 184,000 metric tons of CO_2, including: (a) 125,000 tons as a result of investments in stand-alone solar PV/wind systems, and (b) 59,000 tons as a result of investments in wind generation for hybrid grids.

For simplicity, retail systems are assumed to be all solar PV, although the project will support both PV as well as wind systems. Similarly, for simplicity, grid-capable RET for hybrids is assumed to be wind turbines, though the project will support wind, micro hydro, PV or any combination thereof. Variations in RETs do not affect the fuel displacement rates (hence CO_2 emission rates) so long as equivalent services are obtained (i.e., kWh of generation from gasoline or diesel generators or lighting from kerosene) and the assumed utilization rates (hours/day) of RET and displaced technologies remain the same.

Key assumptions for calculating emission reductions		
PV systems		
Home systems	50,000 installed	
Kerosene displaced per year	liters/year	2,400,000
Based on lighting use per household	liters/system	48
Hybrid Grids:		
Wind systems	MW installed	2.0
Diesel displaced per year	liters/kWp	526
Capacity utilization rate		20%
Diesel generator heat rate	liter/kWh	30%
CO_2 emissions rates		
Kerosene	kg/liter	2.6
Diesel	kg/liter	2.8

Domestic benefits

For herders, as a result of their own investments, with GEF other donor support for market development, some 50,000 households are expected to benefit from the program and obtain access to electricity. Substantially more herders will be able to enjoy improved living conditions.

For soum centers**,** as a result of the technical assistance and investment supported by GEF and other donors, delivery of essential public services will be significantly improved because of more reliable and less costly electricity service. Soum households' electricity access also will be substantially improved. An estimated 45,000 people will be provided with access to electricity

via the project. With reliable access to electricity, soum households would enjoy significant increases in quality of lighting as well as possibly a rise in their disposable income as the cost of electricity is less than other energy sources previously used for lighting (lighting with kerosene, diesel, animal fat, candles, car batteries, and dry cell batteries). In addition, greater access to electricity provides opportunities for income generating activities, allows more flexible working hours, and generally improves rural living conditions.

For national renewable energy agenda, as a result of stronger institutions and improved policy environment, rural electrification planning will be improved with strengthened public and private partnerships to provide rural electrification access. Broad improvement of sector governance and regulation will be achieved.

Incremental cost matrix

	Baseline	Alternative	Increment
Domestic Benefits	Small increase in herder electricity access as the general economic conditions improves. Little improvement of electricity services in soum centers is expected. Institutional capacity is expected to increase gradually.	• Significant increase in herder electricity access; • Reduced system losses of soum grids; and • Increased reliability and reduced operational cost of off-grid soum center electricity supply.	• 50,000 additional sales of SHSs and small wind systems to herders; • Rehabilitation of 30 soum grids; and • Generation capacity in 20 soum grids augmented by renewable energy technologies.
Global Benefits	Negligible	A total reduction of 184,000 metric tons of CO_2 over 20 years.	184,000 metric tons of CO_2 over 20 years directly from project investment Significant additional CO_2 emission reduction as a result of earlier and larger than baseline utilization of renewable energy resources, such as grid-connected wind farms.
Costs	Baseline cost is not estimated and is netted out in incremental cost accounting.	• Funds supporting technical assistance to build capacity, develop policies, and improve management. • Investments supporting market development (smart subsidies for retail systems), soum grid loss reduction, and RET-based hybrid systems.	Total TA funding of US$3.1 million and investments of US$19.9 million. GEF co-financing of US$3.5 million is proposed, including $2.1 million for TA and $1.4million for investment

Annex 17: STAP Roster Review

MONGOLIA: Renewable Energy and Rural Electricity Access Project

March 18, 2006

SATP Review Comments
on the Project Executive Summary
of Renewable Energy and Rural Access Project for Mongolia

Mikio Matsumura

Conclusion

I endorse the Project that is expected to improve living conditions of Mongolian people in rural area by providing access to electricity. I think the Project is identified and planned at an adequate timing of the country's transition from centrally-planned economy to a market-based one.

It is clear that no energy source of electricity other than mobile renewable energy sources is more adoptable to nomadic herders. However, sustainability of electricity supply by renewable energy in rural area highly depends on both reliability and maintainability of equipment used to transform renewable energy to electricity. The Project aims to make a sustainable system for the use of renewable energy in rural Mongolia based on lessons learnt from some past projects that focused mainly on provisions of equipment. It seems a quite reasonable approach to proceed with the proposed three sub-components. I strongly endorse that improved electricity service in Soum centers is a key of a successful implementation of the entire Project since Soum centers are foothold of supply and maintenance for RE equipment as well as bases for nomadic herders. I have no major questions to be raised, but have some suggestions that could be considered and incorporated during coming project preparation stage. They are shown below.

Suggestions

a) Product quality assurance standards for SHS/SMALL WTS: Considering very severe climate conditions of rural Mongolia and frequent installation-removal of the equipment with moving of nomadic herders, adequate requirements for durability should be specified in the standard technical specifications. As much trouble shooting data in the past RE projects should be collected and analyzed.

Response: Agree. The project will learn from similar efforts in the China Renewable Energy Development Project which has had extensive experiences with herders in Inner Mongolia. Surveys and field investigations of the currently in-use SHSs/Small WTSs by Mongolian herders will also be conducted during project preparation and in the early stages of project implementation so that standards and quality control measures will be practical and effective.

b) Recycle system and waste management of batteries: Usually, batteries are used with solar PV or small wind turbines to store electricity generated during off-use time. The battery has the shortest life-time in the SHS/SMALL WTS, and should be replaced periodically. A secure recycle or waste management system for batteries should be established with product delivery/repair system. The batteries including acid solution may cause contamination of soil and do harm to domestic animals if abandoned.

Response: Agree. Recycling of the batteries and waste management will be incorporated into the after-sales support program design of the project.

c) Possible productive use of electricity: Use of electricity will surely improve quality of life of herders mainly by lighting and TVs. But some productive use of electricity should be identified to let herders be more affordable to SHS/Small WTSs.

Response: Agree. This is a key linkage which the project will explore and take advantage of. The project team will work with the rural development team of the Bank to pursue potential synergetic activities. Experiences in China's Inner Mongolia will also be studied.

d) Monitoring and evaluation: National Renewable Energy Center (NREC) is proposed to monitor the project, however, it is suggested to assign foreign/domestic consultants to assist supervision of Soum component.

Response: Agree. There will be additional and independent monitoring and evaluation efforts for the project, especially in the early stages of implementation, to ensure that the project stay in the right course towards its major objectives.

(end)

Annex 18: Map

MONGOLIA: Renewable Energy and Rural Electricity Access Project