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Report No: 35352-AM

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR 3.5 MILLION
(US$5.0 MILLION EQUIVALENT)

AND A

GLOBAL ENVIRONMENT FACILITY TRUST FUND GRANT

IN THE AMOUNT OF US$3.0 MILLION

TO THE

REPUBLIC OF ARMENIA

FOR A

RENEWABLE ENERGY PROJECT

MARCH 6, 2006

Infrastructure Department
South Caucasus Country Unit
Europe and Central Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective December 30, 2005)

Currency Unit	=	Armenian Dram (AMD)
AMD450	=	US$1
US$0.00222	=	AMD1

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ABS	Asset backed security
AMD	Armenian dram
BOT	Board of trustees
CAS	Country Assistance Strategy
CDM	Clean Development Mechanism
CC	Cascade Credit CJSC
CBA	Central Bank of Armenia
CFF	Cafesjian Family Foundation
DCA	Development Credit Authority of USAID
EBRD	European Bank of Reconstruction and Development
EMP	Environmental Management Plan
ERR	Economic rate of return
FI	Financial institution
FM	Financial management
FMR	Financial monitoring report
FRR	Financial rate of return
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GIS	Geographic Information System
GOA	Government of Armenia
ICR	Implementation Completion Report
IDA	International Development Association
KfW	Kreditanstalt für Wiederaufbau
MOE	Ministry of Energy
MOFE	Ministry of Finance and Economy
NGO	Non-governmental organization
NPV	Net present value
OM	Operational Manual
PFI	Participating Financial Institution
PPA	Power Purchase Agreement
PRSP	Poverty Reduction Strategy Paper
PSRC	Public Services Regulatory Commission
R2E2 Fund	Renewable Energy and Energy Efficiency Fund

SHPP	Small hydropower power project
WPP	Wind power project
SLA	Subsidiary loan agreement
TA	Technical assistance
UHP	Urban Heating Project
VAT	Value added tax
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency of International Development

Vice President:	Shigeo Katsu
Country Director:	Donna Dowsett-Coirolo
Sector Director:	Peter D. Thomson
Task Team Leader:	Gevorg Sargsyan

ARMENIA

RENEWABLE ENERGY

PROJECT APPRAISAL DOCUMENT

EUROPE AND CENTRAL ASIA

ECSIE

Date: March 6, 2006 Country Director: Donna Dowsett-Coirolo Sector Director: Peter D. Thomson Project ID: P083352 Lending Instrument: Specific Investment Credit	Team Leader: Gevorg Sargsyan Sectors: Renewable energy (100%) Themes: Other environment and natural resources management (P);Infrastructure services for private sector development (S) Environmental screening category: Financial Intermediary Assessment Safeguard screening category: FI
Global Supplemental ID: P090058 Lending Instrument: Specific Investment Credit Focal Area: C-Climate change Supplement Fully Blended?: Yes	Team Leader: Gevorg Sargsyan Sectors: Renewable energy (100%) Themes: Other environment and natural resources management (P);Infrastructure services for private sector development

Project Financing Data

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

For Loans/Credits/Others:
Total Bank financing (US$m.): 5.0
Proposed terms: 10 year grace period, final maturity of 40 years, a service charge of 0.75% and commitment fee of 0.5%
Total GEF financing (US$m.): 3.0

Financing Plan (US$m)

Source	Local	Foreign	Total
BORROWER	0.30	0.15	0.45
SUB-BORROWERS	4.40	2.20	6.60
INTERNATIONAL DEVELOPMENT ASSOCIATION	3.00	2.00	5.00
GLOBAL ENVIRONMENT FACILITY	1.80	1.20	3.00
EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT	5.20	1.80	7.00
CAFESJIAN FAMILY FOUNDATION	2.00	1.00	3.00
Total:	16.70	8.35	25.05

Borrower: REPUBLIC OF ARMENIA
Responsible Agency: MINISTRY OF ENERGY

Estimated disbursements (Bank FY/US$m)									
FY	2006	2007	2008	2009	2010	2011			
Annual	0.00	1.40	1.50	1.30	0.50	0.30			
Cumulative	0.00	1.40	2.90	4.20	4.70	5.00			

GEF Estimated disbursements (Bank FY/US$m)									
FY	2006	2007	2008	2009	2010	2011			
Annual	0.10	0.90	0.90	0.60	0.30	0.20			
Cumulative	0.10	1.00	1.90	2.50	2.80	3.00			

Project implementation period: Start: June 1, 2006 End: June 30, 2010
Expected effectiveness date: May 30, 2006
Expected closing date: December 31, 2010

Does the project depart from the CAS in content or other significant respects? [ ]Yes [X] No
Ref. PAD A.3

Does the project require any exceptions from Bank policies? [ ]Yes [X] No
Ref. PAD D.7
Have these been approved by Bank management? [ ]Yes [ ] No
Is approval for any policy exception sought from the Board? [ ]Yes [X] No

Does the project include any critical risks rated "substantial" or "high"? [ ]Yes [X] No
Ref. PAD C.5

Does the project meet the Regional criteria for readiness for implementation? [X]Yes [ ] No
Ref. PAD D.7

Project development objective ***Ref. PAD B.2, Technical Annex 3***
The project objective is to increase the privately owned and operated power generation utilizing renewable energy.

Global Environment objective ***Ref. PAD B.2, Technical Annex 3***
The project global objective is to reduce greenhouse gas (carbon dioxide) emissions by overcoming barriers to the development of renewable energy.

Project description ***Ref. PAD B.3.A, Technical Annex 4***
Component A: Assistance to remove barriers and support project implementation, including improvement of the legal and regulatory framework, capacity building, support in facilitating investments in renewable sub-projects, development of mechanisms to leverage additional financing, implementation and monitoring, and limited commodity support.

Component B: Financing of investments for the development of renewable energy projects.

Which safeguard policies are triggered, if any? ***Ref. PAD D.6, Technical Annex 10***
OP 4.01 Environmental Assessment, OP4.37 Dam Safety, OP 7.50 Projects on International Waterways.

Significant, non-standard conditions, **if any**, for: ***Ref. PAD C.7***
Credit effectiveness:
- The Agency agreement, satisfactory to the Association, has been executed on behalf of the Borrower and the R2E2 Fund.
- The GEF Grant Agreement has been duly executed and delivered and all conditions precedent to its effectiveness or to the right of the Borrower to make withdrawals thereunder, except only the effectiveness of this Agreement, have been fulfilled.

- The Board of Trustee has adopted the Operational Manual satisfactory to the Association.
-the Subsidiary Loan Agreement between the R2E2 Fund and the PFI, satisfactory to the Association, has been duly executed.

Grant effectiveness:

- The Development Credit Agreement has been duly executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals thereunder, except only the effectiveness of this GEF Trust Fund Grant Agreement, have been fulfilled.

Covenants applicable to project implementation:

- The R2E2 Fund shall maintain financial management systems acceptable to the Bank and their financial statements, Statement of Expenses and Special Account will be audited by independent auditors acceptable to the Bank and under terms of reference acceptable to the Bank. The annual audited statements and audit report will be provided to the Bank within six months of the end of each calendar year. In addition, quarterly financial statements will be provided at the end of the month following the quarter.
- The R2E2 Fund shall submit, by October 31 of each year, its operational budget for the following year to the Bank for its review and adopt the agreed budget before December 31.
- The R2E2 Fund shall not amend its Operational Manual and Charter without prior approval of the Bank;
- The GOA shall ensure, until the completion of the Project, that the necessary resources, staff, powers or functions of the R2E2 Fund shall not be deprived in order not to affect materially and adversely the ability of the R2E2 Fund to perform any of its obligations to carry out the Project.

ARMENIA
RENEWABLE ENERGY

CONTENTS

A. STRATEGIC CONTEXT AND RATIONALE

1. Country and sector issues[1]

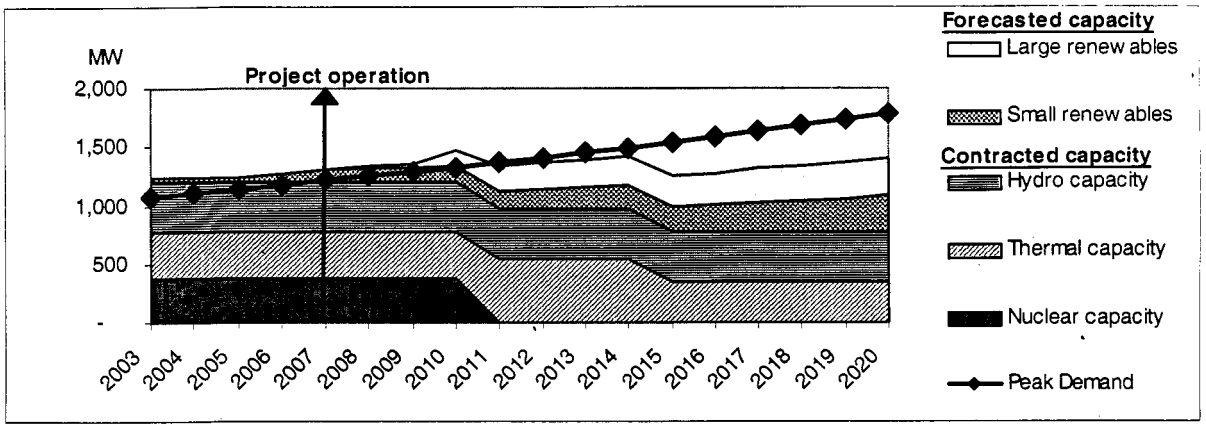
The Republic of Armenia is a small landlocked country with limited energy resources to satisfy its needs. Armenia has no oil and natural gas reserves, and imports nearly all its energy (oil and oil products from Georgia, Iran, Russia and Europe; gas exclusively from Russia through Georgia; and nuclear fuel from Russia). Given the regional geopolitical instability and Armenia's closed borders with two of its neighbors, the high reliance of electricity generation on imported fuels (more than 70 percent is generated by imported natural gas and nuclear) makes the Armenian economy vulnerable to fluctuations in fuel prices and their supply. The severe consequences of fuel supply disruptions on the Armenian economy and people's lives surfaced during the energy crisis (1992-95) when the electricity supply declined to 2 to 4 hours a day and the collapse in industrial activity and national income was massive. Armenia receives natural gas from Russia at subsidized prices (US$53 for 1000 cubic meters), and if the geopolitical situation changes and the subsidy is removed, the magnitude of a gas price increase, especially in the light of rising international oil and gas prices, would be significant.

Following the energy crisis Armenia has achieved remarkable results in reforming the power sector. It has restored round-the-clock supply of electricity, brought the tariffs to cost-recovery levels and successfully privatized the majority of the energy sector assets, including the electricity distribution network. A strong regulator (established in 1997) played and continues to play an important role in the sector. Reforms are steadily improving the sector financial performance, including improved payment discipline, reduction of losses and related elimination of the quasi-fiscal subsidies, as well as sector efficiency and quality of power supply. The key remaining challenge is to ensure sustainable and reliable power supply by: (a) shifting reliance from costly sources of energy (e.g. electricity for heating) to lower cost alternatives (home insulation, gas, solar heating); (b) increasing the energy diversification and achieving a higher degree of energy security through the utilization of indigenous renewable energy resources.

Presently, Armenia has sufficient electricity generating capacity to meet electricity demand, but new capacity is a high priority, as demand (expected to grow at 2-3 percent annually) is estimated to outstrip supply when the 400MW nuclear plant ends its operating life (see Figure 1 that illustrates the scenario when the nuclear plant is shut down in 2011). Also, electricity supply is affected by aging and deteriorated thermal and hydropower plants; 70 percent of the country's hydroelectric plants are more than 35 years old and 50 percent are more than 50 years old; overall, 40 percent of the power plants are more than 30 years old.

[1] For more details, see Annex 1

Figure 1 Electricity Generation Capacity and Peak Demand



* The capacity projections assume 25 percent safety margin on the peak demand
** Winter import from Iran through the SWAP is excluded due to the absence of formal agreement with Iran
*** Thermal capacity projection includes the new Yerevan thermal plant of 205MW that will be constructed through JBIC funding.

Armenia has significant renewable energy resources, but they play a limited role in the country's energy supply. Approximately 740 MW of small hydropower, wind and geothermal resources have been identified, which, if implemented, would represent approximately 25 percent of the present installed capacity. Hydropower and some of the wind resources are estimated to be most attractive. According to various estimates, over 250 MW of capacity could be added through small hydropower projects (SHPPs) that are competitive with other forms of new generation. As part of the Project preparation activities, 65 small hydropower projects (SHPP) were identified with total capacity of 120 MW that are suitable for development. A recently completed wind resource assessment estimated the wind energy potential of Armenia at 470 MW and 1360 GWh per year.

Overall, the existing legal and regulatory framework in Armenia is supportive to the development of renewable resources. The Energy Law and the recently adopted Law on Renewable Energy and Energy Efficiency clearly articulate the importance of renewable resources and provide a framework for facilitating their development. Among others, the legal framework guarantees purchase of electricity produced for all small renewable power plants at the tariffs set by the Public Services Regulatory Commission (PSRC) and provides payment assurance. The PSRC resolution has set attractive tariffs for newly constructed run-of the river SHPPs (USc 4.5/kwh), and wind and biomass plants (USc 7.0/kwh) for 15 years. These tariffs and the off-take obligation greatly enhance the predictability of revenue streams for small renewables and should contribute to the establishment of a sustainable market for them.

Despite the significant opportunities for renewable projects, private investment in such projects is impeded by a number of barriers and constraints (see Annex 1 for a detailed analysis of barriers):

- *High capital outlay and preparation costs for small renewable projects*: Renewable projects typically have high investment costs with long payback periods, and project preparation and development costs make up a significant share of overall project costs. For small renewable projects the preparation cost can be as much as 20 percent of the

total cost. As a result, these projects are perceived to have high or marginally competitive costs compared to conventional projects;

- *Limited access to long-term finance and management capacity constraints*: While the projects are generally small and therefore not attractive for international investors, the access to local finance is also limited due to the underdeveloped local financial market, financial institutions (FI) with limited management capacity, lack of long-term funds, and prudential norms of the Central Bank of Armenia (CBA) that prevent financing of relatively large projects given the small size of the financial sector;
- *Unfamiliar risk profile of borrowers and related perception of high risk for renewable energy projects*. There is a considerable gap between the real and perceived risk by local FIs with respect to renewable energy projects. FIs do not have the necessary technical and commercial skills to properly assess and prepare renewable energy projects;
- *Lack of experience* of project sponsors, local FIs and engineering and consulting industry with renewable technologies and the appropriate project structures;
- *Legal and regulatory barriers* with gaps in regulations and procedures for resource allocation; long and often non-transparent process for obtaining the necessary permits, licenses and other required approvals; and tariffs for existing and newly constructed SHPPs operating on artificial water flows requiring further improvements to eliminate uncertainties and attract project financing;
- *Lack of reliable information* about potential sites for renewable energy projects.

2. Rationale for Bank and GEF involvement

The Bank has over a decade of history of effective policy dialogue with the GOA, particularly in the power sector. The Bank's involvement is essential to add credibility to local authorities' efforts to implement the required policies to increase penetration of renewable resources. In addition, the Bank has considerable experience with renewable energy projects and energy sector restructuring in other countries. Finally, under the Urban Heating Project (UHP) the Bank has supported the establishment of the Renewable Energy and Energy Efficiency Fund (R2E2 Fund, or the Fund), which will be the implementing agency for the UHP and this Project. This should enable economies of scale and reduce the implementation-related expenses.

GEF's involvement will help remove some of the barriers and create a sustainable arrangement upon exit. GEF's role in the project will be to overcome barriers to the development of renewable energy resources through commercially sustainable activities. Without GEF participation, private developers may not be able to develop and finance projects that benefit project partners and the country at large. Also, without GEF, there would be a lack of resources to build knowledge about renewable energy among private investors, FIs, policy-makers, and other stakeholders. GEF support will lead to sustainable financing of renewables resulting in long-term reductions of greenhouse gas emissions.

In addition, the Bank and GEF involvement is essential to add creditworthiness to the Renewable Resources and Energy Efficiency Fund (R2E2 Fund) and enhance its ability to replenish and leverage other financing, particularly from EBRD as well as from the Armenian Diaspora without sovereign guarantee.

3. Higher level objectives to which the project contributes

The Poverty Reduction Strategy Paper (PRSP) adopted by the GOA in October 2003 emphasizes the need for policy reforms in five key areas, including promotion of private sector development and improvement of public infrastructure. More specifically, the PRSP states "Maintaining and strengthening energy independence by developing indigenous and alternative energy sources and promoting energy efficiency. Regarding the development of indigenous resources, priority should be given to developing renewable energy production."

The project contributes substantially to the country's energy security by diversifying the energy resource base and utilizing indigenous resources. Increased reliance on renewable energy will also generate environmental benefits. Thus, the project will support key policy areas of PRSP and is also consistent with the CAS objective of promoting private sector growth by strengthening the financial sector and reducing infrastructure bottlenecks.

B. PROJECT DESCRIPTION

1. Lending instrument

The IDA credit in the amount of US$5 million is designed as a specific investment credit that will be on-lent from the Ministry of Finance and Economy through the R2E2 Fund to project developers. GEF will provide a grant of US$3 million in co-financing to cover technical assistance (TA) components of the project. In addition, EBRD and CFF will provide funds to co-finance the on-lending activities.

2. Project development objective and key indicators

The project objective is to increase privately owned and operated power generation utilizing renewable energy. By targeting the development of a niche area of power generation capacity (mainly SHPPs and WPPs), the Renewable Energy Project will increase the role of renewable resources in Armenia's electricity generation mix in the future. The development of renewable energy is worthwhile since: (i) its generation costs are generally competitive with other forms of electricity generation (see Annex 9 for details); (ii) it will increase diversification of electricity supply and energy security; and (iii) it will contribute to the reduction of emissions and pollution. While the capacity added through the Project support will not be sufficient to completely replace nuclear generation, it will still be an important contribution for the retirement of the nuclear plant.

The project global objective is to reduce greenhouse gas (carbon dioxide) emissions by overcoming barriers to the development of renewable energy.

Key indicators

a) Installed capacity (MW) of renewables added to the power grid;
b) Renewable generation (GWh) added to the generation mix;
c) Carbon dioxide emission reductions (CO_2).

It is expected that by the completion of the Project the installed capacity of renewable generation connected to the grid will be around 127 MW, the annual generation of renewable energy will be around 336 GWh, and the annual CO2 emission reductions will reach 0.218 million tons.

3. Project components

During project implementation, the R2E2 Fund will provide assistance to remove barriers for the development of renewable energy and debt financing as well as technical, legal, managerial and business support to a selected number of projects. The Project will contribute to development of about 80 MW of additional renewable energy generation capacity during the first 5 years.

A. Assistance to remove barriers and support project implementation (indicative amount: US$3.65 million, of which US$3 million from the GEF, US$0.45 million from GOA, and US$0.2 million from project developers): This component covers the following areas:

1. Improvement of legal and regulatory framework and capacity building for state agencies: (a) revising the existing legislation and regulations to improve and streamline procedures for transparent and fair allocation of resources (e.g. land rights, water permits, and licenses); (b) developing sub-legislation to operationalize the law on renewable energy and energy efficiency; (c) reviewing and amending the rules of acceptance for small renewable generation for the system operator; (d) strengthening the capacity of the PSRC, the Ministry of Energy (MOE), State Water Committee, and Meteorological Service; (e) limited commodity support to the PSRC and MOE.

2. Support in facilitating investments in renewable sub-projects: (a) TA and capacity building to local FIs, private investors, local engineering and consulting industry, including information and incentives about new renewable energy technologies and associated benefits; (b) developing a comprehensive database of renewable energy resources, with a related open source Geographic Information System (GIS), and a web portal for identification, assessment, and monitoring of potential renewable energy projects; (c) field survey of potential sites; (d) establishing a one-stop-shop for potential investors to facilitate the process of obtaining required permits, licences, and other documents; (e) TA to potential investors for project preparation activities, such as business plans, feasibility studies, and preliminary designs.

3. Mechanisms to leverage additional financing: assistance will be provided to the R2E2 Fund and other implementing agencies to prepare a long-term strategy for the mobilization of additional financing for developing renewable energy, including: (a) roadshows and conferences for potential investors; (b) design and piloting of different financial instruments to accelerate lending to sub-borrowers, replenish funds and enhance the leveraging impact of the Project. These instruments may involve risk-sharing arrangements like partial-risk guarantees, or asset-backed securities, such as bonds or other suitable marketable instruments secured against the portfolio of renewable projects. Furthermore, syndication will be considered for local FIs to jointly finance large renewable projects that would be beyond the financing capacity of a single FI.

4. Project implementation and monitoring: (a) TA, equipment, and logistical support to implementing agencies for project implementation, monitoring, supervision, collection and dissemination of lessons learnt; (b) institutional support to the R2E2 Fund to act as an umbrella institution for CDM transactions relating to the sub-projects[2].

B. Financing of investments (indicative amount: US$21.4 million, of which US$5 million from the IDA credit, US$7 million from EBRD, US$3 million from CFF, and US$6.4 million from project developers):

Private investors will be able to access financing for the development of renewable energy projects. Based on comparative analysis of economic and financial viability of different types of renewable projects, it is expected that the financing will be mainly targeted at SHPPs on natural (run-of-the-river) and artificial (drinking water, irrigation pipes and canals) water flows and WPPs. The sub-loans are expected to be in the range of US$100,000 to $2 million with an average project size of US$500,000. The demand for financing is expected to be significant since different studies confirm that there is significant potential for SHPPs and WPPs that would be competitive with other forms of new generation and that under current conditions could add over 300 MW of capacity. Further, there are already 35 SHPPs with roughly 90 MWs of total capacity that have obtained all or most of the pertinent water permits, land rights and licenses and are ready for implementation if long-term financing is available. In addition to new SHPPs, there is currently about 45 MW of small hydropower capacity operated by the private sector, which is generally in need of rehabilitation and has the potential to increase the electricity output. The World Bank and USAID sponsored round-table discussions and conferences on renewable energy with participation of potential and existing project developers have also revealed significant interest in and demand for this Project. Detailed analysis of available resources and potential sub-projects is provided in Annex 1.

IDA funds will be channeled through the R2E2 Fund. The Fund will provide finance to project beneficiaries: (i) *Base case*: through on-lending to Cascade Credit (CC), a universal credit organization (non-bank financial institution) registered and licensed with the Central Bank of Armenia and owned by the Cafesjian Family Foundation (CFF), a US based Armenian Diaspora organization. CC will pool IDA and EBRD funds and its own co-financing in pre-determined proportions and extend loans to beneficiaries. CC will also seek co-financing from other local FIs, especially those selected to implement KfW financed renewable projects; (ii) *Fall-back options*: on-lending through local FIs or direct lending by the R2E2 Fund to beneficiaries. In the case of direct lending, the R2E2 Fund will outsource the financial/asset management activities to one or more qualified and eligible entities under a fee-based servicing contract (see Annex 4 for details).

In addition, with increasing liquidity of the financial sector as a result of increased availability of long-term financing and development of the local capital market, the R2E2 Fund may substitute lending with risk sharing instruments, such as partial risk guarantees, and/or seek additional financing through different instruments. The Project will also try to promote syndications between commercial banks and other non-bank financial institutions to finance larger projects above the capital capability of a single FI.

[2] CDM capacity-building will be funded by GOA

4. Lessons learned and reflected in the project design

Numerous renewable energy and energy efficiency projects and programs have been implemented in various countries with the financial support of the World Bank, GEF and others (see Annex 2). The project design has especially benefited from these types of projects implemented in the Europe and Central Asia region. Key lessons learned and incorporated into the Project design include:

- Power sector reforms and development of renewables should be part of an integrated strategy to avoid the situation of market reforms not reflecting unique characteristics of renewables, e.g. reforms should allow different tariffs for renewables reflecting their environmental benefits and contribution to energy security.
- The institutional structures should be in place and the policy framework should be clear and supportive of the long-term sustainability of renewables. Government commitment is crucial and should be reflected in the consistency of national and sectoral objectives. Two elements that have facilitated the growth of the grid-connected hydropower market are standardized Power Purchase Agreements (PPAs) and appropriate tariffs, which have significantly lowered transaction costs and risk for investors by providing a more defined framework within which they operate. Provisions should be incorporated to facilitate renewable energy technologies.
- Where possible, existing (preferably private) institutions should be used for managing lines of credit.
- Renewable energy development involves a lot of "learning by doing", which among others highlights the importance of good project monitoring systems and the flexibility to learn and adjust financing and project implementation mechanisms.
- Procurement and disbursement rules for equipment should match the situation on the ground; often procurement rules are too elaborate and cumbersome, increasing transaction costs and extending the project schedule, hence discouraging private entrepreneurs to be involved.
- Procedures for reviewing and approving loan applications should be transparent and clear with minimum bureaucracy and without excessive multi-tier control. For example, the Romanian energy efficiency fund experienced difficulties because of the two-tier structure in the organization (having an Executive Director between the Board of Directors and the Fund Manager). The Bulgarian Fund, on the other hand, has functioned better without an intermediary body between the Board of Directors and the Fund Manager.

Also, the R2E2 Fund is expected to generate its own lessons, which would be valuable to other countries. This knowledge will be disseminated into the region and other countries. This will, among others, be accomplished through World Bank staff participating in the design of renewable projects in other countries and workshops to be held during Project implementation.

5. Alternatives considered

Several alternative project approaches were considered, including:

- *Stand-alone IDA credit for specific projects.* This possibility was not pursued due to the desire to leverage IDA and GEF funds to attract funds from other institutions and private investors. Also, this option is not practical because: (i) project transaction costs would be prohibitively high; (ii) it would be hard to reconcile the preparation and implementation timetable given the large number of typically small projects with frequent changes in their schedule (e.g., due to permit approvals) and ability of developers to finance and implement them. Management of such projects requires a local institution with flexible project assessment and financing procedures.

Stand-alone IDA credit for a large project. This alternative was ruled out since it would not have allowed to use the project funding as seed money to have demonstrational impact that would ensure project scale-up.

- *Equity funds.* Due to underdeveloped capital markets, and non-adequate corporate governance structures, equity funds are virtually non-existent in Armenia. Therefore, the project funding is expected to be mainly in the form of debt financing.

- *Dedicated credit line administered through the banking sector.* This option was rejected mainly since it was found inadequate for the key co-financiers of the Project, the EBRD and CFF. While the option will be explored as a fall-back if the co-financing from EBRD and CFF does not materialize, renewable projects in the range of US$0.5 to $2 million are currently too large for most Armenian FIs. Further, the restrictions imposed by the prudential norms of the CBA, particularly the norm on risk exposure of one borrower, restrict lending opportunities for FIs.

C. IMPLEMENTATION

1. Partnership arrangements (if applicable)

In addition to IDA and GEF funding that will finance respectively investments in renewable projects and technical assistance to remove the existing barriers; a number of other donors are involved in the development of renewable energy in Armenia. The major donors in the sector include EBRD, CFF, and KfW.

EBRD and CFF plan to provide US$7 million and US$3 million respectively as Project co-financing. The EBRD and CFF funding will be pooled with IDA financing and on-lent to private investors for the development of renewable energy projects.

The KfW project, in the amount of EUR6 million, will soon become effective. The funds are made available for the financing of loans to be extended by Armenian commercial banks to owners/operators of small hydropower plants. Eligible for the lending under the program are

small electricity generation projects. Possibilities of co-financing with commercial banks participating in the KfW project will be sought.

USAID will also provide limited technical assistance for mobilization of the private sector and for regulatory reforms.

In addition, Clean Development Mechanisms (CDM) (e.g., the Community Development Carbon Fund) may be utilized to enhance the financial attractiveness and viability of renewable projects for the private sector. Not all of the projects are expected to qualify for the CDM since some projects may not meet the CDM criteria (e.g. additionality) or may have received GEF support, which disqualifies them from the CDM. However, a number of projects are expected to qualify for the CDM, which could provide an additional revenue stream (proportional to greenhouse gas emission reductions) during the operating life of the project, thereby improving the financial viability of otherwise marginally attractive renewable projects.

It is expected that with the removal of existing bottlenecks to private operation and investments and with the mainstreaming of renewable energy projects into the energy sector of the country additional funding will be made available by other donors, IFIs, local FIs and the private sector. IFC has already expressed interest in providing financing to the Project at a later stage of project implementation.

2. Institutional and implementation arrangements

The project design and implementation arrangements have been developed in close consultation with the key stakeholders, namely the GOA, PSRC, EBRD, other donors, local FIs, existing and potential project developers and NGOs dealing with renewable energy, environmental and energy efficiency issues.

The project will be implemented by the R2E2 Fund, a revolving fund established by the Government Decree No 799 dated April 28, 2005, to promote the development of renewable energy and energy efficiency markets in Armenia and to facilitate investments in these sectors. The R2E2 Fund is the implementing agency for the Bank's Urban Heating Project as well. The R2E2 Fund may also serve as an umbrella institution for channelling CDM carbon funds to project developers for qualifying projects.

The project implementation as well as overall R2E2 Fund operations are overseen by a Board of Trustees (BOT) consisting of qualified experts from both the private and the public sector with an appropriate mixture of knowledge and expertise and chaired by the Prime Minister. The organizational structure and the project implementation arrangements are graphically illustrated in Annex 6. In addition, a Task Force will be established under the BOT to effectively coordinate policy issues.

The funds available in the investment component of the project will be channeled by the R2E2 Fund to CC owned by the CFF. CC is selected as an implementation partner for the project since it has assembled a strong management team. The CFF has built substantial track record of investing in renewable energy initiatives (solar, wind and hydrogen fuel cell technologies) in Armenia, and CFF has committed to provide at least US$3 million as co-financing for renewable

projects. The due diligence of CC conducted during the Project appraisal showed that CC has appropriate governance and internal control mechanisms and adequate capacity for carrying out sub-project appraisals. CC has developed an Institutional Development Plan endorsed by IDA to overcome existing weaknesses by the time the Project becomes effective.

Direct lending by the R2E2 Fund to project beneficiaries or on-lending through local FIs will be allowed as a fall-back option if the arrangement with CC falls apart for some reason.

3. Monitoring and evaluation of outcomes/results

The BOT and the management of the R2E2 Fund will have overall responsibility for Project implementation and for monitoring of project outcomes. A management information system for Project monitoring and evaluation will be developed by the R2E2 Fund, covering, *inter alia*, the project pipeline, disbursed, committed and invested amounts, cost-sharing with financing partners, cost-effectiveness of sub-projects, defaults, fund reflows, energy produced and GHG reduction. CC will present periodic financial reports to the R2E2 Fund. The Fund will collate these reports and together with its own reports present them periodically (quarterly and annually) to the BOT and the Bank. The R2E2 Fund will also assemble information from the PSRC and the national power dispatch center.

In addition, a sample of sub-projects will be reviewed annually by the Bank to monitor implementation progress. The financial statements of the R2E2 Fund and CC will be audited annually by an independent firm. Also, comprehensive evaluation of the project results will be undertaken during the project mid-term review. Finally, the R2E2 Fund may be required to continue reporting performance to the GOA even after Project closure. Over time, monitoring/evaluation reports should cover the broader market impact and indicators tracking the development of a sustainable national renewable market based on periodic market surveys.
The lessons learnt from Project implementation and related monitoring results will be disseminated by the R2E2 Fund through a regional conference and through a documentary film. In addition, the Project ICR will document key lessons of the Project.

4. Sustainability and Replicability

GOA's strong commitment to the Project is evidenced by the adoption of the Law on Renewable Energy and Energy Efficiency, policies and regulations to encourage renewable energy in Armenia. Moreover, the GOA has highlighted the development of renewable energy resources as a priority in the PRSP.

There are two aspects to the sustainability of the project:

1. Sustainability of implemented projects: The existing legal and regulatory framework should ensure this by providing:

- *Tariffs at full cost recovery level*: The existing tariffs of US cents 4.5/kWh for new SHPPs on natural water flows and US cents 7.0/kWh for wind make these projects commercially feasible and include adequate provisions for operating and maintenance

expenses. In addition, the tariffs for small SHPPs are competitive with alternative forms of new generation and therefore are sustainable.

- *Off-take requirements*: The Energy Law requires that the power distribution company purchases 100 percent of electricity generated by renewable sources of energy, thus assuring revenues for the renewable energy generators to sustain operations up to year 2016. The GOA and the PSRC have agreed to extend this requirement for each renewable project to 15 years from the time the operating license is issued.
- *Timely and full payment to electricity generators:* Power sector reforms implemented in the country, including the privatization of the distribution company, elimination of the sector financial deficit, establishment of direct contractual relationship between the distribution company and the generators, and the operation of a special transfer account for the distribution company, ensure timely and full payment to the upstream generators and service providers.

2. Replicability of the project: The overarching goal of the Project is to build a sustained market-based capacity to develop and finance renewable energy projects on commercial terms. The following should ensure project replicability:

- Removal of existing legal, regulatory, informational, and other barriers preventing development and implementation of renewable projects;
- Projects funded by the R2E2 Fund are intended to have a "*demonstration effect*" in that they will prove the financial viability of renewable projects and attract additional financial resources from international and local financial institutions and other investors;
- Capacity building for private investors, FIs and other relevant market players to familiarize them with the renewables and remove perceived risks associated with such projects;
- Development of financial markets should lead to increasing availability of long-term funds and ability of local FIs to finance large size projects with relatively long payback periods like renewables.

The sustainability of the R2E2 Fund after Project completion is not a key objective of the Project. The need for continuing Fund operations will be reviewed by Project closure.

Since Armenia is advanced in energy sector reforms and yet has many similarities with other countries of the region, the Project, if successful, may be replicated regionally.

5. Critical risks and possible controversial aspects

Risks	Risk Mitigation Measures	Risk Rating With Mitigation
To project development objective		
Changes in the legal and regulatory framework, such as abolition of off-take requirements and revision of tariffs	Mitigation of these risks will be addressed through the on-going World Bank involvement in the sector reform. Also, the Project TA components will ensure active participation to further enhance the emphasis on renewables.	M
Private sector (prospective project owners) is not willing to borrow for renewable energy projects	There is a substantial number of already identified project sites. In addition, there are over 30 small hydropower projects with a cumulative capacity of over 90MW that have obtained all or most of construction licenses, land and water rights, permits and completed feasibility studies. With the removal of existing bottlenecks, capacity building, public outreach activities, and other TA supported by the Project most of these projects should be financed and implemented.	M
To component results		
Competence of R2E2 Fund staff	To mitigate this risk, detailed qualifications have been developed for the key staff of the R2E2 Fund. The World Bank's and other donors' oversight role will be to bring into the team the experience and lessons learned from other countries, and make sure that the R2E2 Fund has the right qualifications from the start.	M
Capacity of CC to implement the project	During the Project appraisal due diligence of CC was carried out by both the World Bank and EBRD, which showed that CC has adequate capacity to implement the Project. In addition, an Institutional Development Plan was developed to overcome the existing weaknesses. The project will finance TA to CC in the areas requiring sector specific expertise. Also, during implementation the EBRD will play an important role at the credit committee or supervisory board of CC. Should CC fail to implement the Project adequately a fall-back implementation arrangement will be used. The resulting delays in implementation should not exceed 2 to 3 months.	M

Loan defaults	The tariffs provide for full cost recovery; hence, borrowers will have a profitable operation and should be in a position to repay the loan. Also, adequate collateral will be identified during loan approval.	M
Overall Risk Rating		M

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

6. Credit conditions and covenants

Condition for effectiveness:

For IDA credit

- The Agency agreement, satisfactory to the Association, has been executed on behalf of the Borrower and the R2E2 Fund.
- The GEF Grant Agreement has been duly executed and delivered and all conditions precedent to its effectiveness or to the right of the Borrower to make withdrawals thereunder, except only the effectiveness of this Agreement, have been fulfilled.
- The Board of Trustee has adopted the Operational Manual satisfactory to the Association.
- The Subsidiary Loan Agreement between the R2E2 Fund and the PFI, satisfactory to the Association, has been duly executed.

For GEF grant:

- The Development Credit Agreement has been duly executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals thereunder, except only the effectiveness of this GEF Trust Fund Grant Agreement, have been fulfilled.

During project implementation:

- The R2E2 Fund shall maintain financial management systems acceptable to the Bank and their financial statements, Statement of Expenses and Special Account will be audited by independent auditors acceptable to the Bank and under terms of reference acceptable to the Bank. The annual audited statements and audit report will be provided to the Bank within six months of the end of each calendar year. In addition, quarterly financial statements will be provided at the end of the month following the quarter.
- The R2E2 Fund shall submit, by October 31 of each year, its operational budget for the following year to the Bank for its review and adopt the agreed budget before December 31.
- The R2E2 Fund shall not amend its Operational Manual and Charter without prior approval of the Bank.
- The GOA shall ensure, until the completion of the Project, that the necessary resources, staff, powers or functions of the R2E2 Fund shall not be deprived in order not to affect materially and adversely the ability of the R2E2 Fund to perform any of its obligations to carry out the Project.

D. APPRAISAL SUMMARY

1. Economic and financial analyses

Relative costs of small renewable projects vs. alternative forms of new generation and/or import are key determinants of the financial and economic viability of the Project. The generation costs of SHPPs on natural and artificial water flows (USc 2.5-4.5/kWh) are comparable to the costs of a new combined-cycle gas thermal plant (USc 4.0-5.0/kWh), the lowest cost generation option for future expansion, and are well below the costs of a large hydropower plant (USc 6-7/kWh). The tariffs for WPPs are less competitive; however wind resources are expected to account for a small share of total generation and contribute towards a "renewable obligation". In addition, the sale of emission credits through the CDM should enhance the viability of otherwise marginally competitive renewables, including WPPs.

Due to the demand-driven nature of the Project, the actual portfolio of projects will be identified initially before effectiveness of the project and later during project implementation. Therefore, the economic and financial analyses for this framework type project has been carried out for three representative renewable projects, which are assessed to be the most competitive based on costs and existing tariffs: (i) SHPP on artificial water flow (drinking water and irrigation pipelines and canals), (ii) run-of the river SHPP, and (iii) WPP. Each of three projects is assumed to have installed capacity of 1MW, which is the average capacity for small renewable projects in Armenia.

The table below summarizes key assumptions and financial indicators for the three projects:

	SHPP on artificial water flow	SHPP on natural water flow	WPP
Investment cost	US$300/kW	US$500/kW	US$1,000/kW
Plant factor	50%	35%	35%
Tariff (VAT exclusive)	2.2 cent/kWh	4.5 cent/kWh	7.0 cent/kWh
Profitability index (NPV/Investment)*	28%	53%	39%
FRR	15%	17%	15%
Payback period	5.5 years	4.5 years	6.5 years

* Based on discount rate of 10 percent.

Thus, all three of the projects above are financially viable with acceptable FRRs and cash flows. The FRRs for SHPPs remain above 12 percent assuming a 10 percent increase of investment cost and simultaneous 5 percent decline in the plant factor; while the FRR for the WPP falls to 11 percent. With the removal of the remaining legal and regulatory, informational, institutional and other barriers for the development of renewables the financial returns should improve still further with the concurrent reduction of risks. This should ensure the involvement of the private sector in the renewable business, generate adequate deal flow and enable the R2E2 Fund as well as local FIs to leverage additional funds for investments in renewables.

Cost-benefit analysis has been carried out to estimate the economic viability of the Project with the following underlying assumptions:

- The available funds will be allocated in the following proportions: 30 percent to SHPPs on artificial water flows, 50 percent to run-of the river SHPPs, and the remaining to WPPs;
- The existing tariffs will prevail throughout the useful life of the investments;
- Loans will be extended in a revolving mode;
- Project developers will be required to put up a minimum 30 percent as co-financing to the project.

Based on these assumptions the total amount of investments in renewables supported through IDA and EBRD funding and the co-financing by the project developers would total about US$21 million. Due to the revolving nature of the funds, the leveraging impact that the early projects will have by demonstrating the financial viability of renewable projects and lowering perceived risks the funding mobilized for renewable projects during the project life of five years is assessed at US$42 million. This funding will generate net economic benefits of around US$30 million and ERR of 17.1 percent, estimated by adding supplementary value for the reduction of carbon dioxide and for the exclusion of taxes to the FRR. Further, a number of studies suggest that if the effect of market risks is taken into account, the fossil energy generation costs exceed renewable energy generation costs and that adding fixed cost renewables to a fossil generation mix reduces overall generating cost and risk.

2. Technical

The sub-projects to be implemented under the Project are expected to be mostly run-of-the-river SHPPs, SHPPs on irrigation and drinking water pipes and canals, and WPPs since these options tend to result in the least cost renewable electricity generation. Since the project is demand driven by its design, specific technological requirements are not intended to be part of the selection criteria for investment sub-projects. However, the Project will support the application of modern and efficient renewable energy technologies by providing knowledge and adequate incentives to project developers addressed through the technical assistance component of the Project.

3. Fiduciary

Procurement for contracts under component B (on-lending to project beneficiaries) typically will be conducted by respective beneficiaries in accordance with the established local private sector commercial practices acceptable to the Bank and introduced in the Operational Manual for the Project. Procurement under other components will follow standard Bank procurement methods. R2E2 Fund will undertake annual technical audits to ensure proper use of funds in the subprojects component.

The R2E2 Fund has acceptable financial management arrangements in place to meet the current Bank requirements. The annual audited project and entity financial statements will be provided to the Bank within six months of the end of each fiscal year and also at the closing of the project. The project will produce a full set of quarterly Financial Monitoring Reports (FMRs) throughout the life of the project.

4. Social

No negative social impact is anticipated to result from the Project. Involuntary resettlement is not anticipated. Investors of renewables supported by the Project are required to obtain land based on a voluntary land transaction with land owners willing to sell the land at the terms agreeable to them. It is expected that many investors will acquire land from local self-governments on a lease/rental basis that will increase the revenues to the local self-governments. Investors building SHPPs on irrigation pipes and canals are required to agree the use of water with local water users associations, if they exist.

The local population has generally positive views about the existing renewable plants. While the impact of renewable energy plants on employment generation will not be significant after the completion of construction, these plants, especially SHPPs, will require investments in local infrastructure (irrigation canals, distribution cables, etc) with resulting benefits to the local population.

Key project stakeholder groups include: (i) engineering companies and consultancies; (ii) equipment/materials manufacturers; (iii) companies in the financial sector, particularly banks, mortgage and leasing companies as co-financiers; (iv) municipalities where the renewable projects are located; (v) water users associations, if any, in case of SHPPs on artificial water flows; and (vi) local environmental and renewable advocacy groups and NGOs. Most of these stakeholders were consulted during Project preparation to seek their views on the objectives and design of the R2E2 Fund and to generate larger public interest in the facility. In August 2005, the project concept was presented to the stakeholders and NGO community in a special conference to solicit their feedback.

5. Environment

The Project is specifically designed to mitigate GHG emissions through utilization of renewable energy resources to replace fossil fuels. Therefore, it is anticipated that the Project will result in mostly positive overall environmental impacts. During construction and operation only limited negative environmental impacts are anticipated. As the exact locations of investments are not known at appraisal, specific impacts will be identified during the screening process by the R2E2 Fund and CC and mitigated through inclusion of special requirements in detailed designs and bidding documents.

Environmental Assessment Process. Since the project will be implemented by financial intermediary and specifics of the subprojects are not known at appraisal stage, the Project has been assigned an environmental screening category "FI". Nevertheless, it is not anticipated that the project would cause unprecedented large scale irreversible or cumulative environmental damage. To the contrary, by supporting the development of renewable energy, the Project will be largely beneficial to the environment since it will allow the replacement of significant quantities of fossil fuel which otherwise would have been used in power generation.

An Environmental Management Plan for the Project has been prepared by the Borrower. The EMP describes the likely environmental impacts and the ways to avoid/mitigate them. Most of

these impacts are associated with civil works and proper operation of the small hydropower plants, and can be mitigated by proper planning and adherence to good construction practices and occupational health requirements. Particular attention is paid to ensuring a required minimum flow in the rivers on which the small hydropower plants will be built.

The R2E2 Fund, which will serve as a Project Implementation Unit together with CC will review the proposed specific investments in order to determine the appropriate environmental screening category and will require the investor to prepare a subproject specific Environmental Assessment Report and/or Environmental Management Plan, as appropriate. The Operational Manual contains the step-by-step description of the environmental assessment process as well as requirements for compliance monitoring.

The R2E2 Fund will include at least one staff appointed to deal with the EA and environmental management aspects of the projects funded through R2E2 Fund. (As an option, a qualified environmental consultant may be hired by the R2E2 Fund on an "as needed" basis.)

6. Safeguard policies

The Project triggers three Operational Policies: OP 4.01 Environmental Assessment, OP 4.37 Dam Safety and OP 7.50 Projects on International Waterways.

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]	[ ]

The EMP for the Project and Environmental Chapter of the Operational Manual have been prepared and disclosed both in Armenia and in the World Bank's Infoshop. The Project is co-financed by European Bank for Reconstruction and Development (EBRD). In order to streamline the application of safeguard policies of the two institutions and to avoid possible contradictions, the contents of the environmental chapter of the Operational Manual has been agreed upon with EBRD.

Apart from OP 4.01 Environmental Assessment, the Project triggers OP 7.50 Projects on International Waterways, and OP 4.37 Safety of Dams. As per provisions of OP 7.50, the riparian countries have been notified about the proposed project and given a reasonable time to

convey their comments and concerns (see Annex 10). The OP 4.37 is triggered because there is a possibility that some water for small hydropower plants may be derived from the reservoirs already controlled by the existing dams (para. 7 of the OP). However, all the dams in Armenia are included in the on-going Irrigation Dam Safety II Project which is aimed at ensuring required minimum safety standards at all the existing dam controlled reservoirs in the country. Therefore, for purposes of the Renewable Energy project the Borrower was not asked to arrange for one or more independent dam specialists to conduct reviews, evaluations and provide with recommendations as per provisions of para. 8 of the Policy. If deemed necessary, the required information about the status of the dam in question will be obtained from the team implementing the Irrigation Dam Safety 2 Project.

7. Policy Exceptions and Readiness

This project complies with all applicable Bank policies, requires no policy exceptions and is ready for implementation.

Annex 1: Country and Sector or Program Background

ARMENIA: RENEWABLE ENERGY

Armenia's electricity system had been developed as part of a much larger Trans-Caucasus electrical grid and not as an independent system. Dispatch and planning decisions to serve load in Armenia were integrated with the much larger planning decisions of a regional system and generation plants were built to run on imported fuels. Armenia has no oil and natural gas reserves, and imports nearly all its energy (more than 70 percent of the electricity generation). Oil and oil products are imported from Georgia, Iran, Russia and Europe, gas is imported exclusively from Russia through Georgia; and nuclear fuel is also supplied by Russia. Table 1 below shows the current level of installed capacity in Armenia, which has remained unchanged since Armenia's independence.

Table 1: Installed Capacity and Ownership of Armenia's Power Plants

Generation Type and Name	*Capacity*	*Owner*
Thermal	1746	
Hrazdan TPP	1100	Russian Federation
Yerevan TPP	550	Ministry of Energy, GOA
Vanadzor TPP	96	Zakneftgasstroy-Promethey
Hydropower	1032	
Sevan-Hrazdan Cascade	556	RAO "Nordic"
Vorotan Cascade	400	GOA
Small HPPs	76	Various private owners
Nuclear	408	
Medzamor Unit 2	408	GOA (but under financial management of INTER RAO UES)
Total	3196	

Electricity is provided by:

- A nuclear power plant which generates 30-50 percent[3] of the country's electricity depending on plant reliability and the ability to purchase nuclear fuel; after the earthquake of 1988, the plant was shut down and only one of the two (400 MW) units restarted in 1995 in response of Armenia's severe energy shortage; this unit is scheduled for retirement, too, but the specific schedule is uncertain;
- Hydroelectric plants (total installed capacity of approximately 1,000 MW[4]) satisfy 20-40 percent of the country's needs depending on level of precipitation, which varies significantly. Besides, the hydropower generation has declined due to limitations associated with irrigation purposes of the hydropower plants[5];

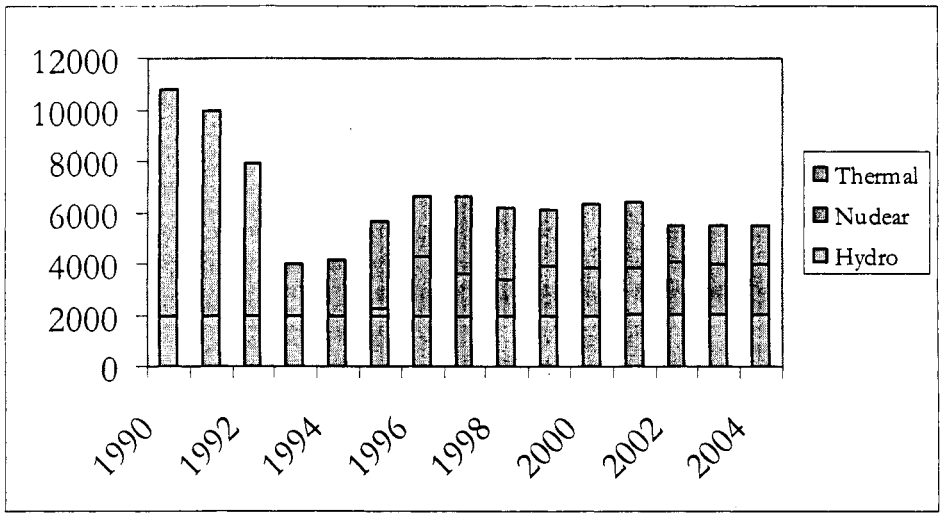
[3] Source: Ministry of Energy

[4] Utility Data Institute and http://www.fe.doe.gov/international/armnover.html

[5] The generation by the Sevan Hrazdan Hydro Cascade has been limited to irrigation purposes in an attempt to prevent further reduction of water in Lake Sevan. In addition, the output of the Vorotan Hydro Cascade declines from the diversion of water to Lake Sevan due to the completion of Vorotan Arpa tunnel.

- The remaining electricity demand is satisfied by thermal power plants (total available capacity of 1,350 MW), which burn either oil or natural gas. The share of the thermal plants in the generation mix varies significantly (from 25 percent to 50 percent).

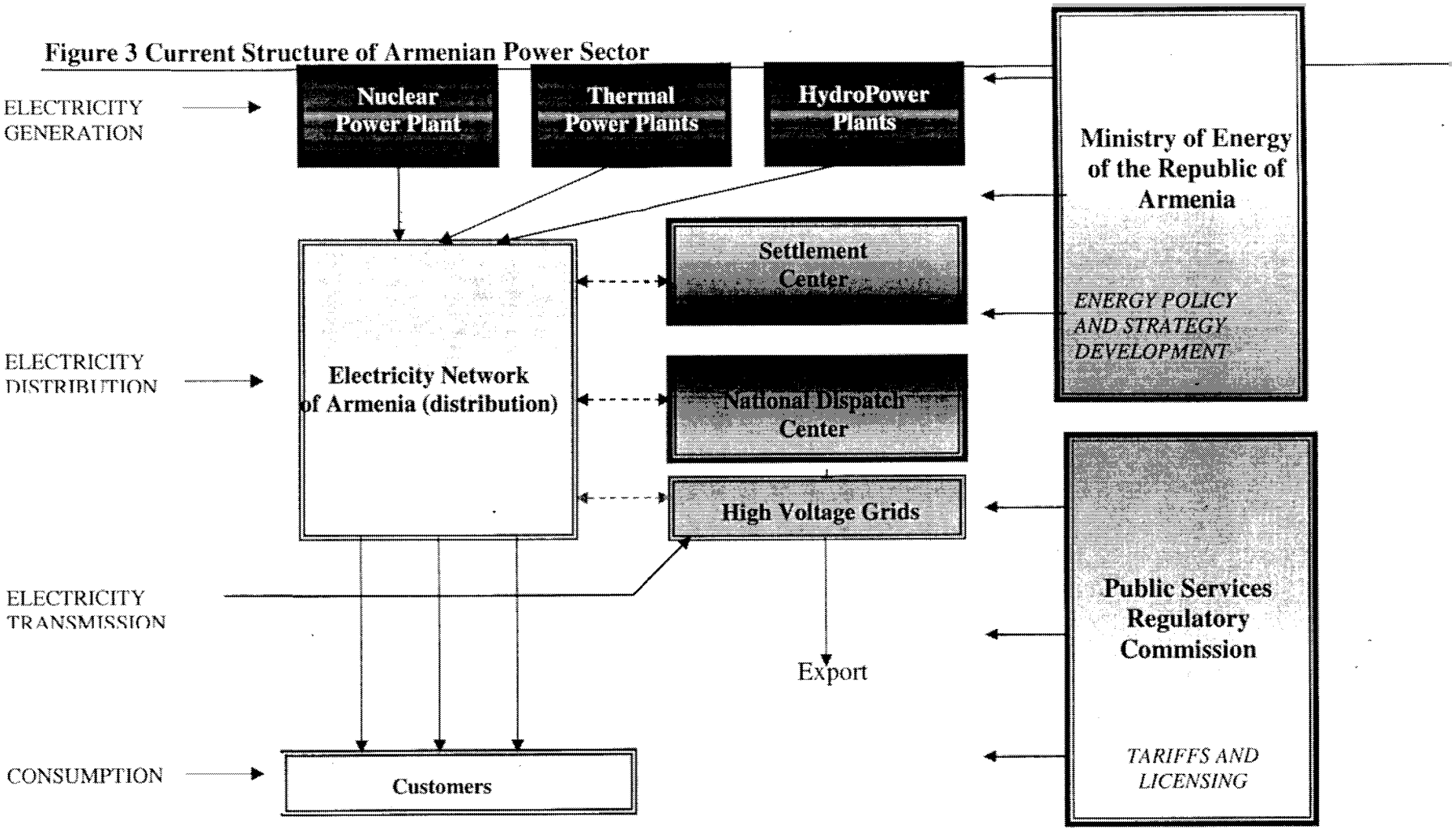
Figure 2: Generation Mix in Armenia throughout the Reforms



With the 1988 earthquake, and the start of the war over Nagorno Karabakh, and the resulting economic and energy blockade and high reliance of Armenian electricity generation on imported natural gas and nuclear fuel, the energy sector of Armenia experienced a severe crisis with the electricity services dwindling to 2 to 4 hours per day, and the entire system – generating stations, grid infrastructure, and users' equipment suffered the effects of repeated, unpredictable outages and restarts. Further, below-cost electricity pricing, coupled with low collections (nearly 50 percent) and high commercial losses (over 25 percent) resulted in massive fiscal and quasi-fiscal subsidies to the power sector reaching an equivalent of 7 percent of Armenia's GDP. The energy crisis caused an abrupt decrease of many macro economical indicators and damaged the economic fabric of the country.

Since 1994 the power sector has undergone major reforms and restructuring. At the core of the reform program were: (i) a gradual transition to cost-based tariffs; (ii) unbundling of part of the state-owned, vertically-integrated utility; (iii) imposition of a new regulatory framework; and (iv) move to introduce private sector participation with resulting successful privatization of distribution assets and over 70 percent of generation assets. The achievements of the power sector reforms are truly remarkable. The sector currently operates based on direct contracts between the privately owned distribution company, and upstream generating plants and service providers. Figure 3 shows the current structure of Armenia's power sector. Collections are at nearly 100 percent of sales and only 4 percent of what should be delivered to customers becomes "commercial" losses. Tariffs are set by a regulator with eight years of regulatory experience now behind it and are generally regarded at the cost-recovery levels. Twenty-four hour service has been maintained since 1995 and the service quality has improved substantially.

Figure 3 Current Structure of Armenian Power Sector



Since the reforms have steadily improved the sector financial performance, efficiency and quality of power supply, the key remaining challenge is to ensure sustainability, affordability, and reliability of the power supply system, thereby reducing the vulnerability of the Armenian economy and improving the quality of life. The supply of fuel is unreliable due to the poor condition of the gas pipelines and geopolitical instability. Also, although at present Armenia has sufficient power generating capacity to meet power demand, new capacity is a high priority, as demand (expected to grow at 2-3 percent annually) will outstrip supply (see Figure 1 in section A1) when the 400 MW nuclear plant ends its operating life. The electricity supply is also affected by aging and deteriorated thermal and hydropower plants; 70 percent of the country's hydroelectric plants are more than 35 years old and 50 percent are more than 50 years old. Finally, Armenia receives natural gas from Russia at a price (US$53 per 1000 m3) that is substantially below the international market price of gas (over US$200 per 1000 m3 Russia charges for its exports to the European markets) and if the geopolitical situation changes and this "subsidy" is removed, the resulting impact of a gas price increase on the Armenian economy will be significant[6].

Several projects are currently underway in the energy sector that will contribute to the expansion of generation capacity, and/or prepare the country for the retirement of the nuclear plant. A second gas pipeline is under construction that will allow gas import from Iran. The pipeline is expected to be commissioned in 2007-2008. A CCGT plant with installed capacity of 200 MW in Yerevan TPP will be constructed through the financing of the Japanese Bank of International Cooperation. In addition, two relatively large hydropower projects with a total installed capacity of around 120 MW are being appraised. Finally, the GOA has adopted an Urban Heating Strategy in 2003, and through the World Bank financed Urban Heating Project, supports adoption and continued use of clean, efficient, safe, and affordable gas-based heating technologies. The gas-based heating should replace part of the electricity demand (especially during the winter months) and ease the anticipated demand gap.

To increase the diversification of energy supplies and energy security, and reduce the risk of supply disruption, the GOA has decided to promote development of renewable sources of energy in Armenia recognizing that renewable energy will not substitute nuclear and/or thermal energy, but will be an essential element in the country's electricity mix. The Energy Law, which was enacted in 1997 and revised by the National Assembly in 2001[7], states among others (Article 5) that the main principles of the state policy in the energy sector are:

> "...
> (v): Efficient use of local energy resources and renewables and the application of relevant economic and legal measures for that purpose;
> ...
> (viii): Ensuring energy security;
> (ix): Promotion of the energy independence of the country, including the diversification of local and imported energy resources and ensuring maximal use of capacities;

[6] In late 2005 Gazprom announced plans to double the gas price for Armenia. The negotiations between the Russian and Armenian governments are ongoing.
[7] Went into effect on April 11, 2001

(x): Ensuring environmental security" [8].

Armenia's energy strategy (Poverty Reduction Strategy Paper (PRSP)) prepared in 2003 clearly emphasizes (among others): "Maintaining and strengthening energy independence by developing indigenous and alternative energy sources and promoting energy efficiency. Regarding the development of indigenous resources, priority should be given to developing renewable energy production".

The Law on Renewable Energy and Energy Efficiency, which was approved in December 2004, provides the legal framework to facilitate development of renewable energy resources and establish a renewable resource and energy efficiency revolving fund. In April 2004, the GOA approved a program to develop small SHPPs in the Lori region, which has the largest hydropower resources. Furthermore, the Energy Law specifies that all renewable energy produced is subject to 100 percent purchase by the electricity distribution company, and a resolution of the PSRC sets attractive tariffs for newly constructed SHPPs operating on natural water flows (4.5 cents/kWh) and wind, biomass and waste (7 cents/kWh) until 2016. These rates compare favorably with the end user electricity tariffs, which are around 5-5.5 cents/kWh range and are testament to Armenia's commitment to promote the development of renewable energy. To enhance the financial attractiveness of renewable projects and increase the predictability of their cash flows the GOA and the PSRC have agreed to extend the electricity off-take and the above tariff rates to each renewable project to 15 years from the date the operating license is issued.

Renewable energy resources are plentiful and should play an important role in Armenia's energy future. Armenia has undeveloped renewable resources that can currently compete with other conventional resources in the generation of electricity[9]. The majority of these projects are small hydropower, but geothermal and wind power are also available and potentially attractive[10]. Solar generation is determined to be less competitive, but it is still considered as an important indigenous energy resource in Armenia, especially for water heating.

SHPPs, which currently contribute less than 2 percent of the electricity supply, have a significant potential for increased contribution. Estimates for the potential for SHPPs vary, but most studies agree that SHPPs are competitive with other forms of new generation and under current conditions could add over 250 MW[11] of capacity (150 MW through run-of-the-river SHPPs, and 100 MW through SHPPs on artificial water flows). A study carried out by Lahmeyer International[12] estimated around 190 viable SHPPs from 543 projects with a total installed capacity of 160 MW and annual generation of 543 GWh. The consulting firm hired during the Project preparation activities has developed a long list of 65 SHPPs with a total capacity of 120MW, which are most suitable for development and a short list of 12 SHPPs with total

[8] Source: Ministry of Energy
[9] PA Consulting, "Assessment of Renewable Resources in Armenia.", under USAID Technical Assistance Program to Armenia, February, 2001
[10] "Assessment of the Geothermal Resources of the Republic of Armenia"; GeothermEx, Inc. for Burns & Roe Enterprises, Inc.; September 1998
[11] "Armenian Small Hydro Projects' Feasibility study and Current Status", PA Consulting, February 2004
[12] "Development Planning in the Armenian Power Subsector ", Lahmeyer International GmbH, 1994

capacity of 31MW, which are financially most viable and ready for implementation (see Table 2).

Table 2: Financially Most Viable SHPPs Ready For Implementation

Company Name	Project Name	Capacity MW	Investment Costs $ / kWt	IRR
Syunik	Apres	1.26	913	38,3%
Mavr	Chanakhchi-2	1.44	625	31,4%
Zoraqar	Ayri	1.10	873	29,5%
Izodrom	Yaghdam	1.00	250	100,0%
Bur Group	Eghvard-1	1.40	964	40,0%
Ani	Jradzor	4.80	599	22,3%
Griar	Getik-1	5.70	642	9,7%
Hydrocorporaton	Argichi	8.50	647	97,3%
Elenex	Aghstev-1	2.70	481	30,3%
Bitlis-Man	Aygezard	0.84	514	17,8%
Ler-Ex	Ler-Ex-Cascade	1.71	760	74,1%
Loraget	Sisakan	0.50	560	16,5%

Wind resources are becoming commercially feasible as the cost of equipment decreases and the reliability increases. A recently completed wind resource assessment[13] estimated the wind energy potential of Armenia at 470 MW and 1360 GWh per year (see Table 3). A number of site-specific assessments have been carried out, mainly in northern and northwestern parts of the country and commercially viable grid-connected wind farm projects with a total capacity of 195 MW and annual generation of 550 GWh have been identified.

Table 3: List of Potential Grid Connected Wind Farm Projects

Site name	Installed Capacity (MW)	Annual Generation (GWh)
Bazum	20.3	62.2
Karachakh 1	124.5	376.7
Zode	50	120.0
Karachakh 2	125	350.0
Zangezur	150	450.0
Total	**469.8**	**1,358.9**

Source: Ministry of Energy

Solar energy potential is considered to be significant in Armenia since most of the country territory is located close to the equator and many of the regions have supportive climatic conditions. According to meteorological observations the duration of solar radiation in Armenia

[13] Two studies were recently completed, one was a cooperative effort between the Governments of Armenia and the Netherlands, and the other was conducted by Solaren in Association with the US National Laboratory of Renewable Resources.

amounts to 2900 hours annually and the solar radiation capacity for some areas reaches up to 1,800 kWh per meter square annually.

Finally, significant geothermal resources exist in Armenia. A reconnaissance study, financed by the Danish Government and completed in April 1998, evaluated the geothermal resources for both heat and electricity generation. The Jermakphur area was identified as suitable for electricity generation[14], estimated to have an electricity potential of 50-100 MW. To confirm these estimates the GOA has requested funding from GeoFund for drilling and feasibility study. Other similar sites exist, which require further assessment.

Barriers to the development of renewable energy

Despite the significant opportunities for renewable projects, private investment in such projects is impeded by a number of barriers and constraints:

- ***Relatively high capital outlay and project preparation costs:*** While costs are site-specific, it is well documented that many renewable projects have higher investment costs than conventional projects with resulting longer payback periods of 7 to 10 years. Furthermore, project development costs for small renewable projects make up a higher percentage of the overall project costs compared to larger conventional projects. Project-specific assessments and energy resource assessments carried out so far in Armenia confirm these findings indicating that for small renewable projects project development costs (identification, feasibility studies, business plans, fund raising, cost of obtaining necessary permits, licenses, and other documents, etc.) can reach up to 20 percent of total project costs. Due to these factors small renewable projects are perceived to have high or marginally competitive costs compared to conventional projects. This is despite the fact that in today's highly uncertain energy environment with widely fluctuating fossil prices and new renewable technologies with rapidly declining learning curves market risk-adjusted generation cost of renewable based electricity is estimated to be lower than the cost of gas based electricity.[15]

- ***Lack of interest by international investors for small projects:*** Project identification activities, which have already been completed in Armenia, indicate that project financing needs are typically US$250,000 for rehabilitation works to US$4 million for new capacity with the average project financing for new capacity of about US$500,000-US$ 1,000,000. Such financial requirements are substantial for the economy and the financial sector of Armenia, but are generally too small to attract the interest of foreign investors and certainly too small to attract the international lending community, private, public or multilateral. For example, project costs need to be in excess of US$10 million for IFC, or EBRD to get involved.

- ***Limited access to long-term finance due to underdeveloped capital market:*** The capital markets, for both equity and debt, are largely underdeveloped. Armenia's securities market, created following the privatization wave in the mid-90s, has a low capitalization at US$23 million (0.8 percent of GDP), and is illiquid with a turnover of less than 1 percent. Trading in the stock exchange is truly symbolic with a small number of

[14] Yerevan Geothermal Pilot Project – Reconnaissance Study, Petroleum Geology Investigators A/S, April 1998)
[15] Studies by Awerbuck, Bollinger, Booth and others.

companies being listed and very low volume of trading. The access to long-term debt is also very limited with local commercial banks, which are dominating the financial sector of the country, offering short (up to 36 months) lending maturities due to the short funding base, high risks related to governance and transparency in the enterprise sector, and lack of capacity of banks. This results in the lack of readily available and affordable financing and lease facilities for grid-connected renewable projects (high capital and low operating costs), and mechanisms to mitigate credit risk for projects with relatively high investment and/or business development costs.

- ***Management capacity and small size of banking sector:*** The management capacity of FIs has not yet adjusted to meet the new situation. Credit policies in many FIs still require lending decisions to be made exclusively on a collateral basis without adequate consideration of borrower creditworthiness or strength of cash flow. Further, renewable projects are too large for most Armenian FIs. In addition, the restrictions imposed by the Prudential Regulations of the CBA, particularly the capital limitations imposed for the risk exposure to single borrowers, restrict lending opportunities of the magnitude indicated above even for the largest of Armenian commercial banks. As a result, banks impose high collateral requirements and charge high interest rates, which are onerous for potential borrowers.

- ***Unfamiliar risk profile of borrowers and perception of high risk*:** The CBA conducts a rigorous, ongoing supervisory process that is grounded in legislation, regulatory reporting and prudential norms. This leads to stronger sense of risk prevention by local FIs. The unfamiliar risk profiles of stakeholders (e.g., utilities, local project sponsors and local financial intermediaries) exacerbate the problem. Further, the past credit history of state owned energy sector entities, with frequent defaults on their loans, reduced their perceived creditworthiness and increased their risk profile. As a result, there is a considerable gap between the real and perceived risk by local FIs with respect to renewable energy projects. Consequently, potential renewable projects with generally predictable and stable cash flows provided by the existing legal and regulatory framework and low proportion of recurrent costs are in essence non-bankable.

- ***Lack of experience of project sponsors, local financial intermediaries with renewable projects and weak engineering and consulting industry that can assist in developing small renewable energy projects:*** There is a general lack of experience with commercial and technical issues, such as available contemporary technologies and the appropriate project structures, associated with renewable projects. Also, the local engineering and consulting firms do not have the experience needed to plan and implement renewable projects. Hiring foreign firms is feasible, but very expensive. As a result, there is a tendency to overestimate the transaction costs and perceived risks. Also, there is little familiarity with suitable project structures.

- ***Legal and regulatory barriers:*** The process for obtaining the necessary land rights, water permits, environmental assessments, construction licenses and other required approvals is often long, cumbersome, non-transparent and not coordinated with other concerned agencies. This creates numerous problems and impediments, such as multiple water

permits being issued to different project developers for the same water source, or land rights being issued to one developer while the water permit for the same site is granted to another developer, or a developer holding the land rights and not undertaking the intended project thus impeding the ability of another developer to invest in that site. In addition norms and procedures for the allocation of resources for SHPPs on artificial water flows are essentially non-existent and tariffs for these SHPPs require further improvements to eliminate uncertainties and attract project financing.

- ***Informational barriers:*** While there are general assessments of overall potential capacity for most of the renewables in Armenia there is a lack of reliable information on potential sites. Site-specific information is either virtually non-existent or is outdated and therefore not reliable. The absence of reliable site specific information impedes the ability of policy-makers and regulators to ensure effective policy-planning, adequate resource allocation and also increases the project preparation costs for project developers.

Country Eligibility, Drive and National Level Support

Armenia ratified the United Nations Climate Change Convention on May 14, 1993 and is, therefore, eligible for GEF assistance in the climate change focal area. Also, Armenia ratified the Kyoto Protocol on April 25, 2003, and therefore has a significant incentive to promote renewable energies, which help reduce greenhouse gas (GHG) emissions.

The R2E2 Fund will provide investments for financing renewable projects, which is in line with the GEF strategic priority of *"... increasing the availability of financing for energy efficiency and renewable energy investments, enterprises and intermediaries, with priority on leveraged private finance ..."*.

Also, one of the R2E2 Fund's principal objectives is to facilitate the creation of an enabling business/regulatory environment in Armenia in which the development of renewable energy becomes attractive to investors and sustainable. In this way, R2E2 Fund directly supports the GEF Operational Program #6: *Promoting the adoption of renewable energy by removing barriers and reducing implementation costs.*

Finally, the major global benefit resulting from the implementation of the Project will be the reduction in the emission levels of GHGs due to reduced use of conventional fuels through the substitution of electricity produced by renewable power plants instead of fossil-fired plants.

As was outlined earlier in this section, Armenia is committed to promote the development of renewable resources. Further, on February 25, 1998, GOA adopted Decree #115 on Measures to Perform Obligations of the Republic of Armenia under a Number of Environmental Conventions. To carry out the basic obligations under the United Nations Framework Convention on Climate Change (UNFCCC), the "Armenia – Country Study on Climate Change" project has been underway since 1996 financed by the GEF. Until now the following activities have been carried out within the framework of the Convention:

- The First National Communication of the Republic of Armenia has been prepared, which included the greenhouse gas inventory, information on anticipated climate change in Armenia and its consequences, a vulnerability assessment of natural ecosystems, impact

on different sectors of economy due to climate change, adaptation measures in regards to negative consequences, as well as a mitigation strategy of greenhouse gas emissions. The National Communication was presented at the 4th Conference of the Parties (Buenos-Aires, 1998), and can be found on the Internet (http://www.nature.am).

- A manual of scientific papers entitled "Armenia: Climate Problems" has been published, which contains surveys of Armenian experts on a variety of climate change issues. An information center furnished with state-of-the-art equipment has been created to support mitigation strategies.
- International cooperation and information sharing related to the execution of the Convention is carried out.
- Starting in 1999, the project "Removing Barriers to Energy Efficiency for Municipal Heat and Hot Water Supply" is underway (GEF-financed and UNDP-implemented), which has been developed in-line with the national strategy on restraining the emission of greenhouse gases, because the heating sector has a great potential for energy savings and reduction of CO2 emissions.
- Currently, measures are being taken to develop and strengthen Armenia's capacity to participate in the Convention on a sustainable basis. Armenia has participated at the 11 Conferences of Parties to Climate Change Convention and its subsidiary bodies. The country has expressed its position on participation in the process of reducing greenhouse gas emissions and stated its willingness to voluntarily undertake commitments, in anticipation of pertinent assistance from developed countries.
- Since Armenia has ratified the Kyoto Protocol preparatory activities are underway to develop and implement collaborative mechanisms such as the "Clean Development Mechanism" (CDM) foreseen under the Kyoto Protocol. Armenia has presented one CDM project, "Nubarashen Landfill Gas Capture and Power Generation Project in Yerevan," which would fall within a sub-category of biomass power projects.

GEF Program and Policy Conformity

The project is proposed to the GEF under Operational Program No. 6 (OP-6): Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs. The specific strategic priorities supported by the project in the context of the GEF Business Plans for FY04-06 and FY05-07 are: (a) - Transformation of Markets for High-volume, Commercial, Low-GHG Products or Processes; (b) - Increased Access to Local Sources of Financing; (c) - Power Sector Policy Frameworks Supportive of Renewable Energy and Energy Efficiency; (d) - Productive Uses of Renewable Energy; and Capacity Building[16]. The relevance of the proposed project for (b) is especially strong since it focuses on mobilizing the resources of local commercial banks and other private financiers by removing actual and perceived barriers to renewable investments. Revolving funds are characterized as one of the proven mechanisms in promoting the objectives of OP-5 and 6.

Also, there is consistency between on-going sector reforms and the strategic priorities of GEF. For example:

- As part of sector reform, tariffs for newly constructed renewables have been changed, making renewable projects more attractive;

[16] Specified in GEF Business Plans for FY04-06 and FY05-07

- Privatization of the distribution network supported by other structural reforms has resulted in elimination of the sector financial deficit and full payments to the small hydropower plants; and
- Streamlining of the licensing process and transparent regulatory framework will reduce risks associated with renewable (as well as other) projects.

The GEF funds under the proposed project would be used to remove barriers and leverage commercial financing in renewable projects by as much as 5-10 times.

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

ARMENIA: RENEWABLE ENERGY

The project design has benefited from the past projects financed by the World Bank and other donors in the country.

Sector issue	Project	Latest Supervision (PSR) Ratings Bank financed projects only	
		Implementation Progress (IP)	Development Objective (DO)
Bank financed:			
Enable the successful adoption and continued use of clean, efficient, safe, and affordable heating in multi-apartment buildings and schools	Heating Project	N/A	N/A
Increase the viability and bankability of Armenian companies through improved planning and development of export links and joint venture deals to enhance investment, imports, exports and technology; and strengthen the lending capacity of the banking system, especially for export-oriented projects.	Enterprise Development Project	S	S
Promote development of renewable energy in Armenia, mainly targeting small hydropower	Renewable Energy Project financed by KfW	N/A	N/A
Improve the quality of water and wastewater services in the Armenia Water and Sanitation Company (AWSC) Service Area	Municipal Water and Wastewater Project (effective Sep. 14, 2004)	S	S

Also, the project drew lessons learned from numerous projects and programs on renewables and energy efficiency, which have been implemented by the World Bank, GEF and others. Examples of such projects include:

- Establishment of a Fund for Geothermal Energy for the ECA region (GeoFund);
- US$200 million financial intermediation project in Turkey for renewable energy through two local development banks;
- Rehabilitation and Expansion of Small Hydro-Power Plants on the Raba River Project, Hungary (GEF-funded)
- Mini - Hydropower Project, Macedonia;
- Zakopane geothermal project, Poland

- A number of Energy Efficiency projects implemented in Eastern Europe (e.g., Bulgaria, Croatia, Lithuania and Romania)
- India's Renewable Resources Development Project;
- Sri Lanka's Energy Services Delivery Project;
- Mexico's projects:
  - Renewable energy for agriculture;
  - Hybrid solar thermal power plant;
  - Large scale renewable energy development project; and
  - Action plan for removing barriers to the full-scale implementation of wind power.

In particular, close coordination has already started with the GeoFund, which has been recently established and has regional coverage. Specific lessons learned during project preparation cover the following aspects:

- Design of a financial mechanism
- Sustainabliliy
- Implemention arrangements, risks and mitigation measures
- Application of renewble technologies

Annex 3: Results Framework and Monitoring

ARMENIA: RENEWABLE ENERGY
Results Framework

PDO/PGO	Outcome Indicators	Use of Outcome Information
The project development objective is to increase the privately owned and operated power generation utilizing renewable energy. The project global objective is to reduce greenhouse gas (carbon dioxide) emissions by overcoming barriers to the development of the renewable energy.	1. Installed capacity (MW) of renewables added to the power grid. It is expected that by the completion of the Project the installed capacity of renewable generation connected to the grid will be around 127 MW; 2. Renewable generation (GWh) added to the generation mix. It is expected that by completion of the Project the annual generation of renewable energy will be around 336 GWh; 3. Carbon dioxide emission reductions (tCO2). It is expected that by the completion of the Project the annual CO2 emission reduction will reach 0.218 million tons.	Unsatisfactory progress on outcome indicators may signal shortcomings in TA for removing barriers and reducing investment costs and capacity building activities, or indicate change in market conditions leading to the need for a revision of existing regulations and tariffs.
Intermediate Results One per Component	**Results Indicators for Each Component**	**Use of Results Monitoring**
Component A: Assistance to remove barriers and support project implementation:		
Improved legal and regulatory framework and enhanced capacity of state agencies.	Laws and regulations to improve the environment for the development of renewables are prepared and enacted.	Slow enactment of laws and regulations may indicate lack of support from stakeholders and require additional consultations with policy-makers and regulators, or it may signal poor quality of consulting work and need for improvement of TORs and more attention to the intermediate deliverables of consultants.
Improved domestic capacity to develop renewable energy projects.	Number of applications/business plans for small renewable project developed. This component will help to develop about 50 applications or business plans during	Low number may signal the need for additional TA for capacity building and awareness raising.

	the initial five years. The renewable energy GIS Integrated Database and web portal provide comprehensive data on renewable resources.	
Designed and piloted financial mechanisms for leveraging additional financing for renewable energy	Aggregated dollar amount of funds for renewable energy development generated through the piloted financial mechanisms.	If the pilots are unsuccessful this may be an indication that the legal framework needs improvements to remove remaining impediments, or that capital markets in Armenia are not ready for the type of schemes piloted. Alternative financing tools should be considered or the scheme should be dropped.
Component B: Growing investment volume of renewable energy projects supported by the R2E2 Fund and PFI.	Aggregate dollar amount of investments financed or leveraged by the R2E2 Fund and PFI will reach US$ 21 million by Project completion.	Slow disbursement of funds may indicate either weak capacity of PFI to identify viable projects and leverage additional funds or inadequacy of TA for project preparation purposes. Fall back option may be triggered or effectiveness of the TA may need to be re-assessed. High demand may indicate the need for attracting additional funds by the R2E2 Fund or for applying higher leveraging ratio.
	Loan repayment rates by the Project beneficiaries	Poor repayment rate may indicate PFI's weaknesses in due diligence process of sub-projects, eligibility and selection criteria of beneficiaries, monitoring mechanisms and inadequate collateral requirements. Additional capacity building of PFI and revision of due diligence and credit assessment mechanisms might be necessary.

Arrangements for results monitoring

		Target Values					Data Collection and Reporting		
Outcome Indicators	**Baseline**	**2006**	**2007**	**2008**	**2009**	**2010**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
1. Installed capacity (MW) of renewables connected to the power grid;	47	50	65	80	105	127	Annual implementation progress reports.	PSRC and Settlement center reporting	R2E2 Fund and PSRC
2. Renewable generation (GWh) added to the generation mix;	137	140	160	208	256	336	Annual implementation progress reports.	PSRC and Settlement center reporting	R2E2 Fund and PSRC
3. Carbon dioxide emission reductions (tCO2).	89,050	91,000	104,000	135,200	166,400	218,400	Annual implementation progress reports and R2E2 Fund calculations.	PSRC and Settlement center reporting	R2E2 Fund and PSRC
Results Indicators for Each Component									
Component A: Laws and regulations to improve the environment for the development of renewables are prepared and enacted.	N/A	Diagnostic study completed	The relevant package is prepared		The package is enacted		Annual implementation progress reports.	R2E2's own records	R2E2 Fund
Number of applications/business plans for small renewable project developed.	N/A	8	18	28	40	50	Annual implementation progress reports.	R2E2's own records	R2E2 Fund
The renewable energy GIS, Integrated	GIS and database		GIS, database	GIS, database	GIS, database		Annual implementation	R2E2's own records	R2E2 Fund

Database and web portal provide comprehensive data on renewable resources	for one marz are piloted		and web portal for three marzes are prepared	and web portal for six marzes are prepared	and web portal for the entire country are prepared		progress reports.		
Aggregated dollar amount of funds for renewable energy development generated through the piloted financial mechanisms ('000' US$)	N/A	N/A	N/A	New financing schemes designed	200	300	Annual implementation progress reports.	R2E2's own records	R2E2 Fund
Component B:									
Aggregate dollar amount of investments financed or leveraged by the PFI or the R2E2 Fund (million US$).	0	2	6	11	16	21	Annual implementation progress reports.	R2E2 and CC reports	R2E2 Fund
Loan repayment rates by the Project beneficiaries	N/A	-	94%	95%	95%	95%	Annual implementation progress reports	R2E2 and CC reports	R2E2 Fund

Annex 4: Detailed Project Description

ARMENIA: RENEWABLE ENERGY

Project preparation activities supported from GEF ($250,000 PDF-B grant) and USAID are well advanced. Key activities that are being implemented through the PDF-B grant include:

- *Design of implementation arrangements and support to the establishment and initial capacity building of the R2E2 Fund*: This includes legal registration of the Fund, development of the Fund Charter, Business Plan and OM detailing the principles and implementation rules governing the Fund and its relations with CC, including details on Fund's scope of activities, financial instruments, governance structure, procurement and financial management systems, eligibility criteria and project processing procedures;
- *Initial public outreach and support in developing renewable projects*: As part of this activity GIS and an Integrated Database of renewable energy projects are created for Lori region of Armenia, which will be web accessible. The GIS and the database will be scaled up to include information for the entire country during Project implementation. In addition, the Project design was introduced and discussed with potential project developers and other stakeholders in a workshop organized during Project preparation;
- *Identification of initial project portfolio*: A long list of projects with roughly 120MW of capacity that are most suitable for development has been identified and on the basis of this 12 SHPPs with combined capacity of 31MW that are technically and financially most viable and ready for implementation are selected and business plans for them are developed
- *Identification of barriers:* Legal, regulatory, institutional, financial and other barriers and restrictions impeding the development of renewable energy were identified and recommendations for dismantling them prepared;
- *"One stop shop":* The concept of "one stop shop" within the R2E2 Fund has been developed where the potential investors can get the information and support for obtaining required permits, licenses, and other necessary documents;
- *Technology transfer:* This involves identification of local capacity for the development of renewable energy technology and assessment of the potential for the transfer of modern technology.

During project implementation, the R2E2 Fund will provide debt financing, TA and other support to remove barriers for the development of renewable energy and technical, legal, managerial and business support to a limited number of projects through the following two components:

A. Assistance to remove barriers and support project implementation (indicative amount: US$3.65 million, of which US$3 million from the GEF, US$0.45 million from GOA; and US$0.2 million from project developers): In addition to providing TA to support investments under component B, this component is expected to result in the addition of least 40 MW extra generation capacity during Project implementation by removing the existing barriers and creating an enabling environment. The long-term effect of this component will be much more significant resulting in an additional 200 to 300 MW of new renewable capacity. The component covers the following areas:

1. Improvement of legal and regulatory framework and capacity building for state agencies (US$0.3 million):

Specific activities to be supported for streamlining laws and regulations include:

- o Developing sub-legislation and regulations to facilitate development of renewable energy;
- o Revising the existing legislation and regulations to improve and streamline procedures for transparent and fair allocation of resources (e.g. land rights, water permits, licenses);
- o Developing regulations, norms, and procedures for safe, efficient, and technically and economically feasible use of water and irrigation pipes and canals for electricity generation purposes;
- o Developing sub-legislation to operationalize the Law on Renewable Energy and Energy Efficiency;
- o Improving the tariff setting mechanism for renewable energy, specifically for existing and newly constructed SHPPs operating on artificial water flows to eliminate uncertainties and attract project financing;
- o Reviewing dispatching rules of the system operator for acceptance of small renewables to the grid;

Capacity building activities offered to state agencies will involve training, other TA, and limited commodity support to:

- o MOE, on policy planning issues of renewables and available new technologies;
- o PSRC on advanced tariff design methodologies, licensing, and evaluating technical and financial feasibility of renewable projects;
- o MOE, Water Resources Management Board under the Ministry of Natural Protection, and meteorological services on tools and methods for identifying, assessing and monitoring renewable capacity;

In addition, limited hardware and software will be provided to the PSRC and the MOE.

2. Capacity building and other support to the private sector (US$2.15 million):

Training and other TA, which depending on the specific needs may include on-the-job training, study tours, conferences and seminars, will be offered to:

- o Project developers on the unique features of renewable technologies (with specific focus on modern and efficient technologies), technical aspects of renewables, financing techniques, preparation of business plans, mobilization of financing, and methods to develop such projects;
- o CC, and loan officers of interested FIs, particularly on assessment of renewable energy projects, environmental screening, provision of methodology for adequate risk analysis (e.g. portfolio management software, scoring systems, etc.);
- o Engineering and consulting firms on technological features of renewables, and associated tools used in preparing engineering designs, business plans and carrying out technical and financial audit of renewable projects.

Support to facilitate investments in renewable sub-projects:

- o Field surveys and monitoring of potential renewable resources, including rivers, water reservoirs, water and irrigation pipes and canals to identify financially viable sites, and to update the existing Scheme of Small Hydro Power Development;

- Development of a comprehensive Integrated Database and a related open-source GIS that will contain comprehensive information on available renewable energy resources (hydro, wind, solar, biomass, geothermal), multi-year monitoring data of wind, hydropower, and solar resources, optimal scheme of hydropower potential utilization, necessary transport, power, and other infrastructure, and socio-economic data. These will provide easy and quick access to local and foreign investors for identifying investment opportunities, preparing feasibility studies and monitoring potential renewable projects;
- Development of the R2E2 Fund website and web portal that will provide access to the Integrated Database and the GIS, and contain information on the Armenian power sector, its main indicators and structure, power sector legislation, rules and regulations, procedures for obtaining necessary licenses, permits, and other required documents;
- Establishing a one-stop-shop within the R2E2 Fund where potential investors could get the information and support for obtaining required permits, rights, licenses, and other necessary documents;
- TA to potential investors for project preparation, including preparation of business plans, feasibility studies, and preliminary designs. This should reduce costs and ultimately risks associated with developing small renewable projects and allow implementing otherwise marginally feasible projects. In addition, this TA should strengthen the capacity of the local consulting industry. The R2E2 Fund will have suficient in-house expertise to assist with preparation of simple projects that do not required extensive field work. Assistance for more complex TA may be provided in the form of matching or conditional grants with required co-funding from the project developer. The Operational Manual of the R2E2 Fund will detail the TA allocation procedure to ensure efficient use of TA funds and their targeting to the projects that are likely to materlialize.

3. Mechanisms to leverage additional financing (US$0.44 million): Support will be provided to the R2E2 Fund and, if necessary, to CC to develop a long-term strategy for the replenishment of funds and mobilization of additional financing for developing renewable energy, including:

- Organization of road shows and conferences for potential investors;
- Design and piloting of financial instruments to accelerate lending to sub-borrowers and enhance the leveraging impact of the Project. Some of the instruments that may be considered for this purpose involve different risk sharing tools (e.g. World Bank partial risk guarantees, USAID development credit authority facility), asset backed securities (ABS) and syndications. In addition, limited review of the legislation regulating security markets will be conducted and, if necessary, amendments made to remove possible impediments and provide sufficient comfort to investors. If successful, ABS would allow to sell pools of renewable sub-loans to a trust, which might be within the R2E2 Fund or as a separate entity that can be mutually managed by the R2E2 Fund and CC. The trust would repackage these sub-loans as interest bearing securities to be sold to the market and floated.

4. Project implementation and monitoring (US$0.76 million):

- TA, equipment, works and logistical support to the R2E2 Fund and CC for implementation and monitoring, including the cost of technical experts, resident advisors, office equipment and furniture, staff salary, costs of audits, transportation, communication, staff training;
- Monitoring of exploration and exploitation of renewable resources, and CO_2 emission reduction;
- TA to the R2E2 Fund to establish adequate institutional arrangements for the intermediation of CDM transactions. This is necessary since the sub-projects will be many and small in size and without support of the R2E2 Fund the transaction costs will be high. [Note: funding for this activity will be provided by GOA];
- Collection, analysis and dissemination of lessons learnt, including compilation of a detailed report, organization of national and regional conferences, and preparation of a documentary film summarizing lessons of project implementation in Armenia.

The list of proposed interventions matched with the existing barriers is presented in Table 4.

Table 4: The List of Proposed Interventions

Barriers	Proposed GEF intervention to remove barriers
High project preparation and investment costs, associated with small-size renewable projects	Assistance in establishing a one-stop-shop where potential investors can obtain complete information about investment opportunities as well as receive support for obtaining required documents/permits (including development of an interactive website). TA for preparation of sub-projects, including feasibility studies, business plans, preliminary designs, etc. (sub-component A2)
Lack of interest by international investors for small projects	Private international investors are not expected to become interested in renewable projects in Armenia only due to the Project intervention. However, the Project will leverage funding from international FIs and other donors, as well as local investors channeled though the R2E2 Fund or directly to renewable projects (sub-component A2, A3)
Limited access to long term finance due to underdeveloped capital markets	Assistance in establishment and operation of the R2E2 Fund that will provide long term finance for on-lending. Design and piloting of financial mechanisms that could increase the leveraging impact of the Project (sub-component A3, B)
Management capacity of local FIs	Capacity-building of the local FIs. The R2E2 Fund and CC seeking co-financing by local FIs (sub-component A2, A3).
Unfamiliar risk profile of borrowers and high perception of risk.	Capacity building for FIs. Early projects financed by CC demonstrating financial viability and low-risks associated with small renewable projects (sub-component A2, A3, B).
Lack of experience of project sponsors, local	Capacity-building and TA to the FIs, project developers and

financial intermediaries with renewable projects and weak engineering and consulting industry that can assist in developing small renewable projects.	consulting and engineering industry to familiarize them with new renewable technologies, technical and financial aspects of renewables (sub-component A1, A3).
Legal and regulatory barriers: the process of obtaining necessary permits, licenses and other documents is long, cumbersome and non-transparent, and tariff setting methods for SHPPs on artificial water flows is ambiguous.	Capacity-building of the PSRC and other entities involved in granting necessary documents, revision of existing legal and regulatory framework to streamline procedures and ensure fair and transparent allocation of resources, establishment of a one-stop shop to facilitate project identification and preparation (sub-component A1, A2).
Lack of information on renewables.	Development of GIS and Integrated Database accessible through the web and containing comprehensive country-wide information on renewable resources. Organization of road shows, conferences, collection, analysis and dissemination of lessons learnt by the R2E2 Fund (sub-component A2, A3, A4).

B. Financing of investments (indicative amount: US$21.4 million, of which US$5.0 million from the IDA credit, US$7 million from EBRD, US$3 million from CFF, and US$6.4 million from project developers):

Private investors will be able to access financing for the development of renewable energy projects. Based on comparative analysis of economic and financial feasibility of different types of renewable projects, it is expected that the financing will be mainly targeted at SHPPs on natural (run-of the river) and artificial (irrigation and drinking water pipes and canals) water flows, and wind farms. The sub-loans are expected to be in the range of US$100,000 to US$2 million with an average project size of US$500,000. It is expected that the total financing, which will be mobilized from IDA, EBRD, CC as well as the equity financing of project developers, will allow adding around 40MW of new renewable capacity to the country's generation mix, representing roughly 125GWh of annual electricity generation.

The demand for the financing is expected to be significant since different studies confirm that there is potential for SHPPs and WPPs that would be competitive with other forms of new generation and that under current conditions could add over 300MW of capacity. Further, there are already quite a few SHPPs with roughly 90MW of total capacity that have obtained all or most of the pertinent water rights, land rights permits and licenses and are therefore ready for implementation if long-term financing is available. In addition to new SHPPs, there is currently about 45 MW of SHPP capacity operated by the private sector, part of which is in need of rehabilitation and has the potential to increase the energy output. USAID sponsored round-table discussions and a conference on renewable energy with participation of potential and existing project developers have also revealed significant interest in and demand for this Project (see Annex 1 for details).

IDA funds will be channeled through the R2E2 Fund. The R2E2 Fund will administer the IDA funds based on an Agency agreement which will be signed between the GOA and the Fund. The Agency agreement will delegate the Fund to on-lend funds and sign contracts on behalf of GOA. The Fund will also serve as the financing mechanism for an IDA financed Urban Heating

Project. The Fund infrastructure and support of operating costs will be shared between the two projects. The Fund will provide finance to project beneficiaries:

a. *Base case*: through on-lending to CC. CC would withdraw funds against sub-loan applications by eligible beneficiaries. The maturity of the on-lent funds would match the maturity of sub-loans and will not exceed eight years, with maximum two years grace period. The R2E2 Fund will transfer money to CC account within 5 working days. EBRD will channel financing directly to CC. CC will pool IDA and EBRD funds and its own co-financing in pre-determined proportions and extend loans to beneficiaries. In addition, CC will seek co-financing from commercial banks to leverage additional funds and diversify the portfolio;
b. *Fall-back option*: on-lending through local FIs or direct lending by the R2E2 Fund to beneficiaries. In the case of direct lending, the R2E2 Fund will outsource the financial/asset management activities to one or more qualified and eligible entities under a fee-based servicing contract.

In addition, with the development of capital markets and related increased availability of long-term financing in the country, the Fund may offer risk sharing instruments, such as partial risk guarantees.

The eligibility criteria for sub-borrowers and sub-projects will be incorporated in the OM, and in the SLA to be signed between the Fund and CC. In general, these criteria will be based on the financial viability of the sub-projects, and the financial and legal standing of the sub-borrowers. Additionally the following will need to be met:

- Projects being financed should increase renewable energy generation (re-financing of existing plants would not qualify for financing); both new and rehabilitation projects would qualify;
- The install capacity of the power plants should not be above 10 MW
- Since the financing is essentially seed money the financing for sub-loans will be capped at US $2 million to reduce risks and finance larger projects;
- Sub-borrowers will be required to contribute at least 30% of total project costs as equity financing. Higher co-financing will be encouraged and this will be one of the selection criteria used by CC in evaluating projects;
- Sub-borrowers will be required to obtain all necessary licenses, land rights and water permits

CC will not be allowed to (i) take any equity stake in the sub-projects until the related sub-loans are fully repaid, and (ii) use project funds to finance sub-projects already financed and/or participated in any of the entities controlled or owned by CFF.

CC would receive funds from the R2E2 Fund and offer the on-lending in both US$ and AMD. CC will bear 100 percent risk on the sub-projects and set the terms and conditions of the sub-loans. The choice of mix between two currencies would also be at the discretion of CC. Given that tariffs for small renewables are set in US$ and investments will be predominantly foreign currency denominated, it is expected that CC will extend loans primarily in US$. Interest payments and principal installments will be denominated correspondingly with adequate margins to cover all risks associated with the sub-projects.

The EBRD/IDA on-lending terms for CC would be set based on the actual cost of debt capital of CC, and not less than the terms applicable to financial intermediaries by the R2E2 fund under the Urban Heating Project (six month LIBOR plus 1). It is estimated that currently the cost of debt capital for US$ denominated funds of CC is about 5 percent. This rate represents the weighted average of US quasi-government securities and the cost of commercial paper in Armenia estimated based on US commercial paper rates adjusted for country risk in Armenia. As a result of the above, the IDA rate would need to be adjusted from time to time to reflect the basket of the EBRD rate and the reference on-lending terms. Given the current cost of debt capital of CC and the tentative lending rates agreed with EBRD the on-lending rate for IDA funds channeled through the R2E2 Fund will be set at around LIBOR+1. For AMD on-lending, CC would be charged the 6 months weighted average deposit rate in AMD, as calculated and published by the CBA. The reference on-lending rates would be set and recalculated every six months, starting January 15 of each year, or the following business day.

CC intends to take security over shares, property, equipment, and other necessary collateral in the sub-project company. CC will then assign this security package to the R2E2 Fund and EBRD as a security against their loans, which would be exercised by the R2E2 Fund and EBRD only in event of default/bankruptcy at CC level. In the unlikely case of CC default in order to manage realization of the pledge it has been proposed to keep the pledge with a collection agent acceptable to the R2E2 Fund, EBRD and CC.

CC will designate a special banking account, acceptable to the R2E2 Fund and EBRD to channel funds related to the Project exclusively through that account. The account, which will be locked up with certain covenants agreed to with the R2E2 Fund and EBRD will be opened in an acceptable commercial bank.

CC will be allowed to seek co-financing by other FIs in case of larger projects. Co-financing would be organized in the form of risk sharing arrangements and syndications whenever possible and feasible. CC would be allowed to act as agent for syndicated sub-loans. Also, CC would be allowed to issue ABSs to leverage financing on the market. The issuance of ABSs will be coordinated with the Fund. To issue ABSs, CC would establish a trust, preferably as an independent legal entity depending on the bankruptcy and securization regime. CC would not be required to capitalize the trust unless the capitalization would help stimulate the appetite of investors for such ABSs. Additional financing through ABSs will have to be re-invested in renewable energy projects in the form of debt financing.

Annex 5: Project Costs

ARMENIA: RENEWABLE ENERGY

Project Cost By Component and Activity	Local US$ million	Foreign US$ million	Total US$ million
Assistance to remove barriers and support project implementation:	2.50	1.15	3.65
Improvement of legal and regulatory framework and capacity building for state agencies	0.20	0.10	0.30
Capacity building and other support to the private sector	1.46	0.69	2.15
Mechanisms to leverage additional financing	0.32	0.12	0.44
Project implementation and monitoring	0.52	0.24	0.76
Investment	14.20	7.20	21.40
Total Baseline Cost	16.70	8.35	25.05
Physical Contingencies	0.00	0.00	0.00
Price Contingencies	0.00	0.00	0.00
Total Project Costs	16.70	8.35	25.05
Interest during construction	0.00	0.00	0.00
Front-end Fee	0.00	0.00	0.00
Total Financing Required	16.70	8.35	25.05

Note: Indicative amounts.

Allocation of proceeds of IDA credit

Description	Amount (US$)	% of expenditure to be financed
1. Sub-loans	5,000,000	100%

Allocation of GEF proceeds

Description	Amount (US$)	% of expenditure to be financed
1. Goods	300,000	100%
2. Consultant Services including audits	1,900,000	80%
3. Training	160,000	100%
4. Incremental operating costs	480,000	100%
5. Unallocated	160,000	
Total	3,000,000	

Annex 6: Implementation Arrangements

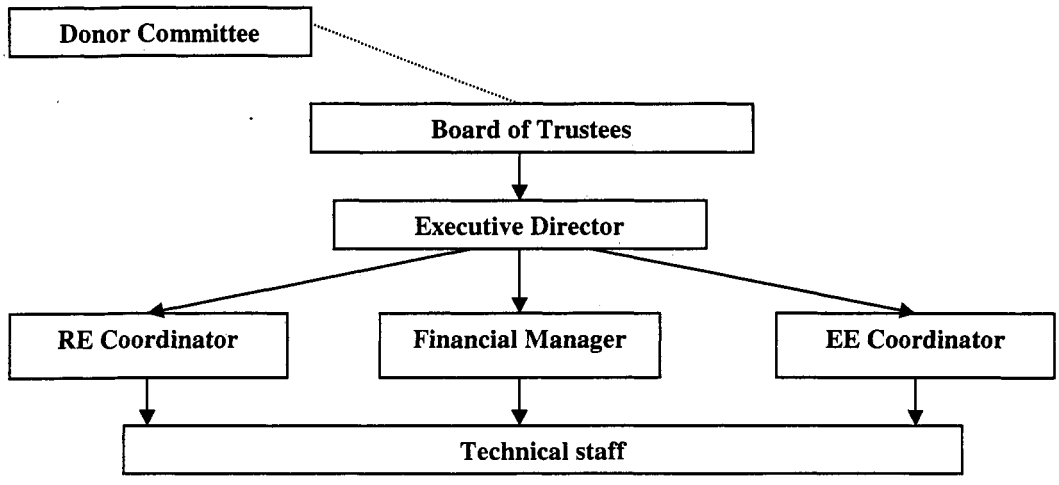
ARMENIA: RENEWABLE ENERGY

The key stakeholders include existing and potential project developers, NGOs dealing with renewable energy, environmental and energy efficiency issues, the GOA, the PSRC, key co-financiers (EBRD, Cafesjian Family Foundation), and local FIs. Extensive consultations, bi-lateral discussions have been carried out with these stakeholder groups to develop the Project design and scope. Specifically, the barriers impeding the development of renewables in Armenia as well as the measures needed to remove them (as addressed under the TA component of the Project) have been largely identified through stakeholder consultations. The feedback from the stakeholders so far has been positive due to the positive environmental impact that the Project is expected to have, the close alignment of Project objectives with the GOA's policy priorities in the energy sector and the overall attractiveness of the renewable projects for the private sector.

The project will be implemented by the **Renewable Resources and Energy Efficiency Fund (R2E2 Fund or Fund)**, a revolving fund established with the objective to promote the development of renewable energy and energy efficiency markets in Armenia and facilitate investments in these sectors. The Fund has been set up as a non-commercial entity governed by the Board of Trustees (BOT) and managed by a qualified management team under a director (see Figure 4 below). The overall framework for the Fund operation is defined in the Charter, while the details of the principles and implementation rules governing the Fund, including details on its scope of activities, financial instruments, governance structure, procurement and financial management systems are spelled out in the OM. R2E2 Fund will undertake annual technical audits to ensure proper use of funds in the subprojects component.

Project implementation as well as overall R2E2 Fund operations will be overseen by the BOT. The BOT, chaired by the Prime Minister, consists of ten members, with eight members representing the public sector and two representing the private sector and NGOs engaged in the areas of energy efficiency and renewable energy. The public sector members are represented by the Ministry of Finance and Economy (MOFE), Ministry of Energy, Ministry of Nature Protection, Ministry of Urban Development, Ministry of Territorial Administration and the Central Bank of Armenia (CBA). The BOT will be chaired by the Prime Minister.

Figure 4 Renewable Resources and Energy Efficiency (R2E2) Fund Organization

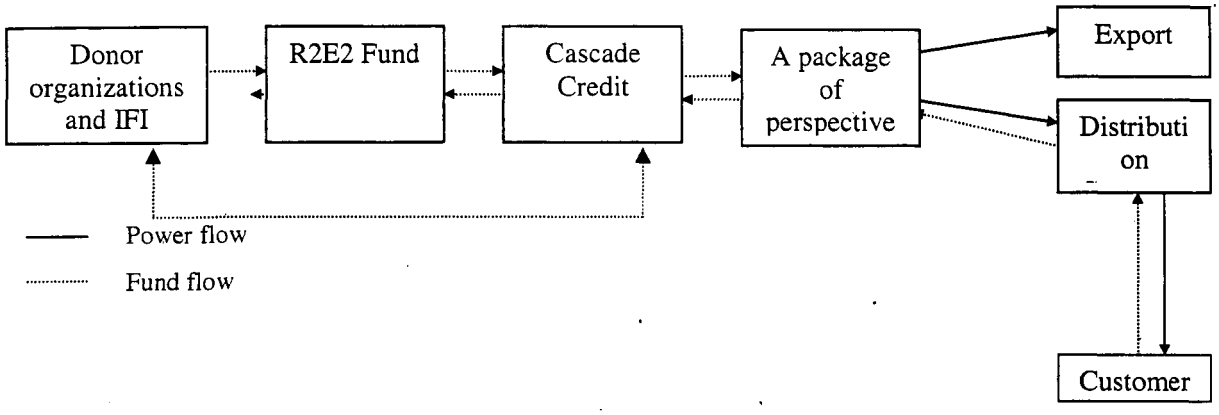


The operating costs of the R2E2 Fund initially will be financed from the World Bank UHP, the World Bank /GEF renewable energy project and GOA co-financing. Later, income from (on-) lending and contributions from other donors and the GOA will add to the Fund's income as well. It is expected that by completion of the project the Fund will continue its operations and obtain financing from its own revenues, from the GOA and from other donors.

To ensure effective coordination of donor activities a **Donor Committee** will be established with representatives of all the key donors and the GOA. Initially the donor committee will include representatives of the World Bank, EBRD, KFW, and USAID. This committee will also provide policy advice and on-going consultations to the R2E2 Fund Board.

The functional roles and responsibilities between R2E2 Fund and different stakeholders are presented in the figure below.

Figure 5 Relationship between R2E2 Fund and other entities



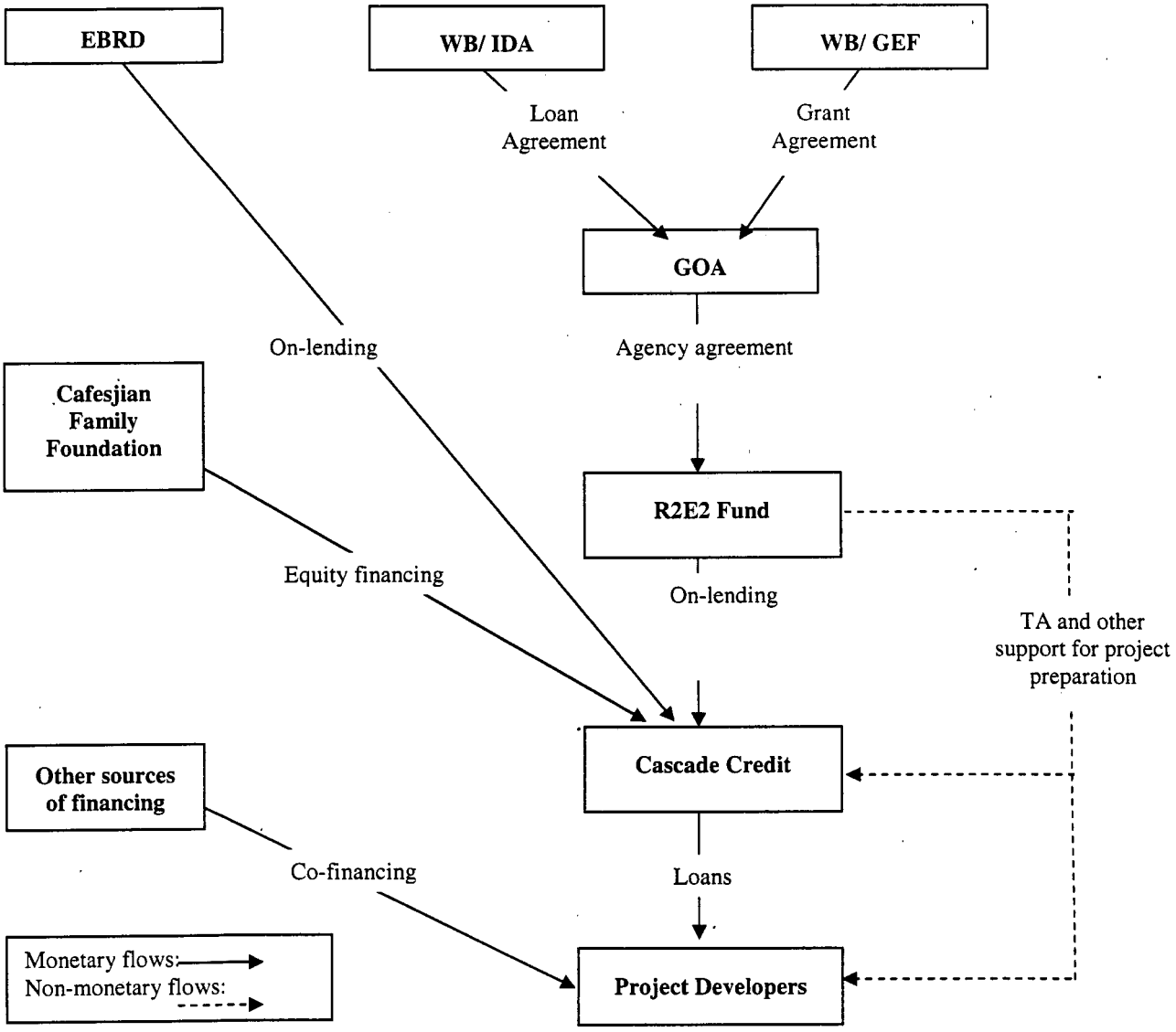
The funds available under the investment component of the Project will be channeled by the R2E2 Fund to CC. Figure 6 presents project implementation arrangements.

CC is a relatively new financial organization in the financial system of Armenia. It is fully owned by the Cascade Capital Holding Group, and licensed by the CBA to provide financial services in the form of equity, structured finance, investment, working capital loans and other financing products. Cascade Capital Holding also incorporates three other financial companies, namely Cascade Investments, Cascade Insurance and Cascade Bank. The primary owner of the Cascade group is the Cafesjian Family Foundation USA, as founded by Gerard L. Cafesjian. The mission of CFF is to promote the economic and social development of Armenia through a broad range of activities, from the promotion of arts and heritage to investment projects. The CFF is a US chartered 501.(C).3 non-profit organization, with resources in excess of US$150 million.

CC is selected as an implementation partner for the Project since CFF has a substantial track record of investing in a variety of renewable energy initiatives in Armenia. Specifically the CFF

renewable energy portfolio includes Solaren LLC, which has been involved in development of solar heating and cooling technologies in Armenia; Zod Wind CJSC, which is pioneering development of wind power; and H2 Economy, which is doing research and development in the area of hydrogen fuel cell technology. CC has assembled a strong management team with adequate skills and capabilities to analyze the financial viability of renewable energy projects as well as to help structure them correctly. Finally, the CFF has committed to provide at least US$3 million as co-financing for renewable projects.

Figure 6 Project Implementation Arrangements Under Base Case Scenario



The World Bank carried out a simplified due diligence of CC during pre-appraisal, and found CC a suitable partner for the project. The due diligence highlighted some areas that will need to be strengthened to ensure effective use of Project funds and maximum efficiency in managing risks.

In particular, CC would need to further develop and enhance its management information system (accounting and reporting) and internal controls. CC is already receiving TA from USAID to address some of these shortcomings. In addition, CC has developed an Institutional Development Plan acceptable to the Bank. EBRD has also performed due diligence of CC.

Funds for financing renewable investments will be disbursed by the R2E2 Fund to CC against sub-loan applications. CC should report a diagnostic of the respective portfolios on a three month basis starting January 15th or the following business day. The reporting format should include: (i) cumulative committed, disbursed and outstanding balance vs. on-lent funds divided by currency denomination; (ii) number of sub-loans and pipeline; (iii) weighted average lending rate and maturities; (iv) cumulative portfolio performance (non-performing loans); (v) for each sub-loan: a brief project description, committed, disbursed and outstanding balances, lending rates and maturities, sub-loans performance (repayments, delays, write offs), main economic and financial ratios of the sub-projects, and off-take tariffs.

Direct lending by the R2E2 Fund to project beneficiaries or on-lending through local FIs will be considered if for some reason the deal with CC falls apart. In the case of direct lending the Fund may outsource the financial/asset management activities to a qualified entity under a servicing contract. In the case of lending through FIs the experience of KfW small hydropower project and R2E2 Fund from the World Bank Urban Heating Project will be extensively utilized.

Figure 7 Implementation Arrangements Under Fall Back Option (Direct Lending)

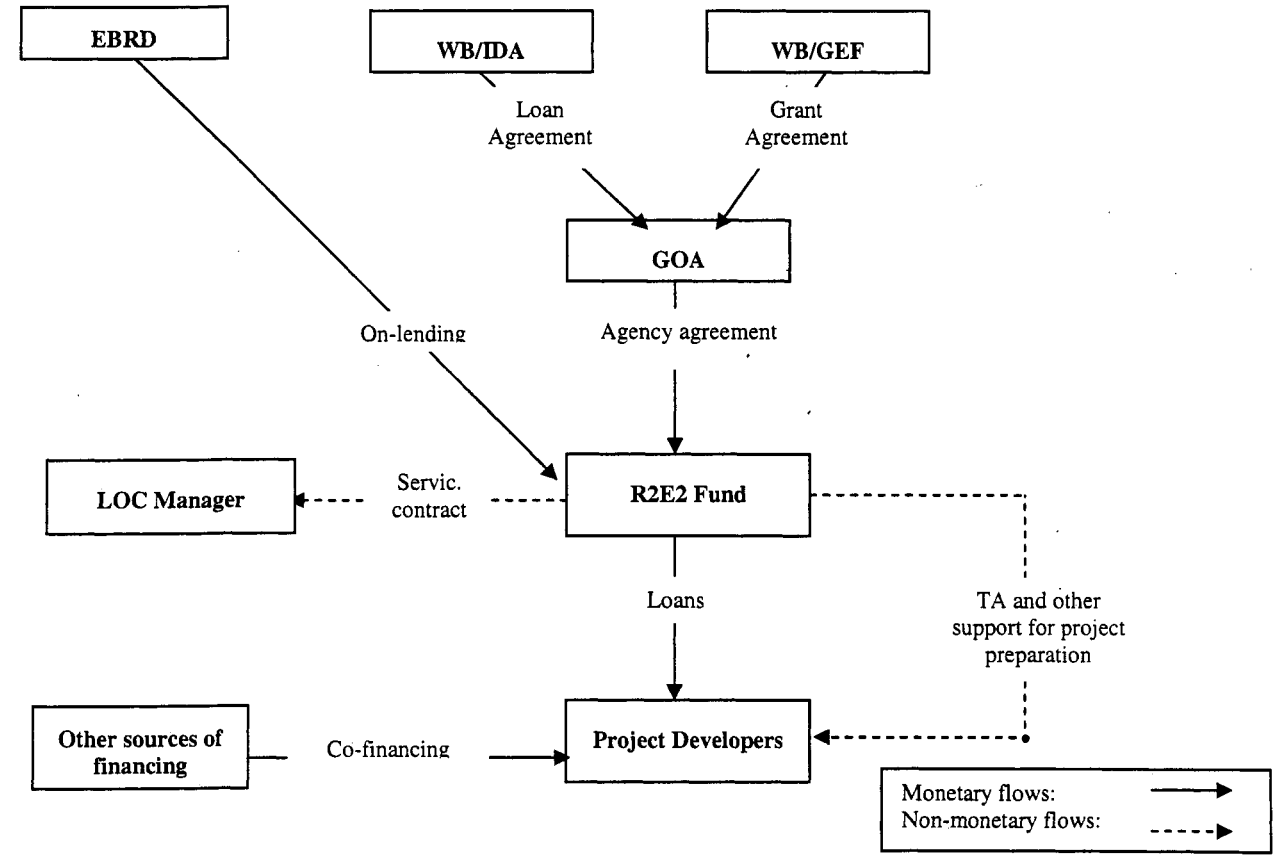
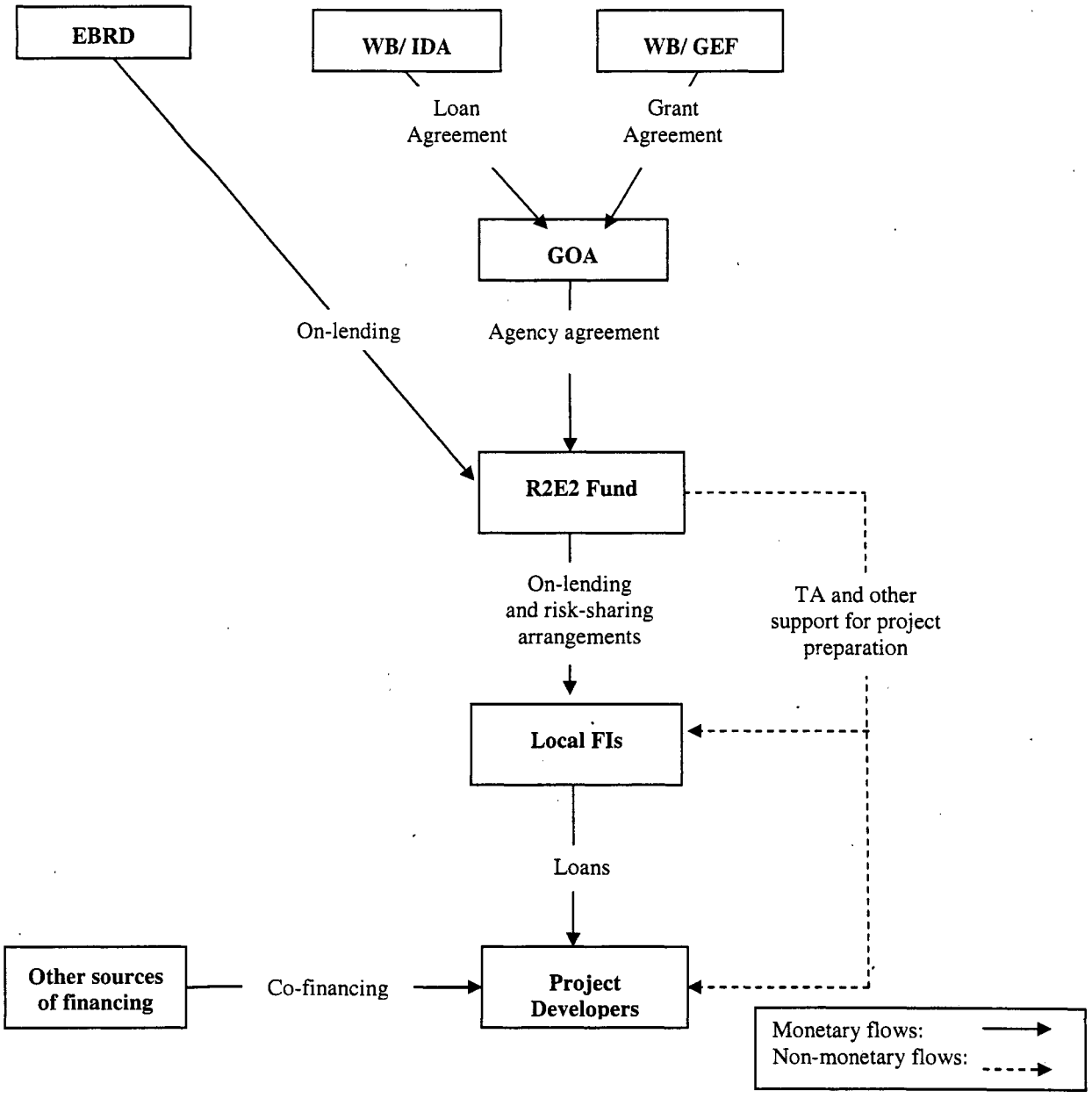


Figure 8 Implementation Arrangements Under Fall Back Option (On-Lending Through Local FIs)



Annex 7: Financial Management and Disbursement Arrangements

ARMENIA: RENEWABLE ENERGY

Country Issues.

The draft CFAA report, which is being finalized currently, concluded that the overall fiduciary risk[17] in Armenia is significant. The key reasons are: (i) inadequate capacity of core control and supervisory agencies performing the audits within the public sector; (ii) although most of the basic laws are in place with respect to various entities' (private sector and public enterprises, including state non-commercial organizations) financial reporting, but compliance remains a problem and authorities need to improve the quality of auditing, monitoring and supervision.

However, the fiduciary risk of the stand-alone financial management arrangements for Bank-financed investment projects in Armenia is considered low. The Government counterpart funding remains a major concern but actions have been taken by the Government and the Bank to monitor the status of this problem. Weaknesses in the banking sector mean that there are inadequate commercial banks to manage the special accounts. The project financial staffs are considered adequate. The audit arrangements are acceptable and no significant issues have been identified.

A financial management assessment was conducted for the project. The assessment found that the R2E2 Fund has developed satisfactory specific procedures to ensure proper financial accountability of this project.

Strengths and Weaknesses.

The significant strengths that provide basis of reliance on the project financial management system include: (i) significant experience of the R2E2 Fund management (the R2E2 Fund director used to be a Financial Manager of the Transport Project for a number of years) in implementing Bank-financed projects for past several years; and (ii) adequate financial management procedures described in the draft manual.

The weaknesses of the R2E2 Fund are the lack of the adequate software for performing business functions, lack of accounting staff and training plan for the staff in WB policies and procedures.

Funds Flow.

IDA and GEF funds will be channeled through the R2E2 Fund. Project funds will flow from (i) the Bank, either (a) via a Special Account, which will be replenished by withdrawal application, or (b) by direct payment by withdrawal application, and (ii) the Government, via the Treasury at the Ministry of Finance and Economy (MoFE) by request of the R2E2 Fund. Both Bank and Government funds will be managed solely by the R2E2 Fund.

The R2E2 Fund will provide finance to project beneficiaries: *(i) Base case*: through on-lending to CC. In this case the EBRD will channel financing directly to CC. CC will pool IDA and EBRD funds and its own co-financing in pre-determined proportions and extend loans to beneficiaries. CC will also seek co-financing from other local FIs, especially those selected to

[17] Risk of illegal, irregular or unjustified transactions not being detected, measured on a four point scale according to the CFAA Guidelines (low, moderate, significant or high).

implement KFW financed renewable projects. *(ii) Fall-back option*: On-lending through local FIs or direct lending by the R2E2 Fund to project beneficiaries (see PAD, Annex 6 for details).

Staffing.
The new financial management organizational structure of the R2E2 Fund has been clarified and approved during the current assessment and provides for an accounting team comprising a Financial Manager, Chief Accountant (as required by Armenian legislation), and disbursement/loan officer with the appropriate job descriptions. A qualified financial manager was recruited in February 2006.

Accounting Policies and Procedures.
The accounting books and records of the R2E2 Fund will be maintained on an accrual basis and project financial statements, including quarterly FMRs, are going to be presented in United States dollars. A financial management manual (FMM) is being finalized based on the agreed organizational structure of the FM team to reflect relevant accounting policies and internal control procedures. All PFIs should have sound financial management and accounting system in place which is also regulated and monitored by the Central Bank of Armenia. Most of the financial institutions in Armenia produce their financial statements in accordance with IFRS.

Internal Audit.
The R2E2 Fund is not going to have an internal audit function and none is considered necessary given its size.

External Audit.
The audit of the project will be conducted by independent auditors acceptable to the Bank and on terms of reference (TOR) acceptable to the Bank. There is a list of audit firms eligible to perform audits of World Bank financed projects in CIS countries, which is updated regularly, and there is a standard audit TOR applicable for ECA, which is also updated regularly to take account of the developments in the overall Bank audit policy.

The annual audited project and entity financial statements of the R2E2 Fund will be provided to the Bank within six months of the end of each fiscal year and also at the closing of the project. The project financial statements will be based on the quarterly FMRs and will include: (i) Balance Sheet, (ii) Summary of sources and uses of funds; (iii) Summary of uses of funds by project components; (iv) SOE summary schedule, (v) Statement of the Special Account, and (vi) notes to the financial statements. Single audit opinion is required on all the above listed financial statements. The entity financial statements will include Balance Sheet, Income Statement, Cash Flow Statement, Statement of Changes in Equity, and Notes comprising a summary of significant accounting policies and other explanatory notes.

The contract for the audit awarded during the first year of project implementation may be extended from year-to-year with the same auditor, subject to satisfactory performance. The cost of the audit will be financed from the proceeds of the credit.

Audit Report	*Due Date*
Financial statements – R2E2 Fund continuing entity include Balance Sheet, Income Statement, Cash Flow Statement, Statement of Changes in Equity and Notes on significant accounting policies and other explanatory notes.	Within six months of the end of each fiscal year and also at the closing of the project
Financial statements of project based on the quarterly FMRs and include balance sheet, summary of sources and uses of funds, summary of uses of funds by project components, SOE summary schedule, statement of Special Account and notes to FMRs.	Within six months of the end of each fiscal year and also at the closing of the project
Other (specify)	None

Reporting and Monitoring.

Project management-oriented quarterly Financial Monitoring Reports (FMRs) will be prepared for project monitoring and supervision and the indicative formats of these have been discussed and agreed with the Bank. The formats of the FMRs have been agreed with the borrower. The FMRs should include sources and uses of funds, summary of uses of funds by project components, SOE summary schedule, statement of Special Account and notes to FMRs.

Information Systems.

The R2E2 Fund uses 1C accounting package and this software has been used by a number of PIUs. The package has been functioning in the PIU for a while, and no major problems have been noted so far. The major drawback of the package is that it was designed for PIU accounting only, which has limited accounting and reporting functions. The accounting package with all the relevant accounting and reporting modules applicable to business entities is required to be implemented at the R2E2 Fund. The accounting software should also have loan portfolio module to account for the loans granted and repayments received from PFI(s). The R2E2 Fund is planning either to upgrade the software with one which would include those functionalities or to acquire new software package with all the required functionalities.

Supervision Plan.

During project implementation, the Bank will supervise the project's financial management arrangements in two main ways: (i) review the project's quarterly FMRs and six-monthly management reports as well as the project's annual audited financial statements and auditor's management letter; and (ii) during the Bank's supervision missions, review the project's and CC's financial management and disbursement arrangements (including a review of a sample of SOEs and movements on the Special Account) to ensure compliance with the Bank's minimum requirements. As required by the Bank and ECA guidelines, Country Financial Management Specialist for Armenia and Georgia will carry out regular annual FM supervisions of the project.

Disbursement Arrangements.

The R2E2 will be responsible for the disbursements of the funds from the IDA credit and GEF and for operation and maintenance of the Special Accounts for this project. There will one special account for the IDA funds and another for the GEF. The accounts will be opened and maintained in US dollars in a Commercial bank under terms and conditions acceptable to IDA. The authorized allocation for the Special Account linked to the IDA credit shall not exceed $500,000 and for the GEF financed activities $300,000. Guidelines for the disbursements under the sub-loan category, the on-lending arrangements and the requirement for sub-borrowers' contribution will be documented in the Operation Manual. Direct payments facility will also be available and limit set is 20% of the authorized allocation of the respective special accounts.

Allocation of proceeds of IDA credit

Description	Amount (US$)	% of expenditure to be financed
1. Sub-loans	5,000,000	100%

Allocation of GEF proceeds

Description	Amount (US$)	% of expenditure to be financed
1. Goods	300,000	100%
2. Consultant services including audits	1,900,000	80%
3. Training	160,000	100%
4. Incremental operating costs	480,000	100%
5. Unallocated	160,000	
Total	3,000,000	

Statement of Expenditure: Certified statement of expenditure will be used for this project for payments against contracts for sub-loans, goods, training and incremental operating costs and for contracts for the services of consulting firms below US$100,000 equivalent and $50,000 for individual consultants. Request for other payments exceeding these limits will be submitted on summary sheets accompanied by full documentation (invoices, receipts etc). The R2E2 and where applicable PFIs is required to maintain all supporting documentation including sub-loan agreements and make these available for audit, bank supervision's missions etc; the document retention period is one year after the receipt of the final audit.

Annex 8: Procurement Arrangements

ARMENIA: RENEWABLE ENERGY

A. General

Procurement for the proposed project would 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 Credit and the GEF 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 Borrower 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: Goods procured under component A (assistance to remove barriers and support project implementation) of this project would include a limited quantity of IT equipment (hardware and software) for the R2E2 Fund. Taking into account estimated cost and its nature (available "off-the-shelf"), the procurement of IT equipment will be done following Shopping method and using the Bank's sample documents for Shopping agreed with or satisfactory to the Bank.

Procurement under component B. (Financing of investments): Works, equipment and other goods under this component would be financed from the sub-loans issued by the non-bank financial institution to private investors for development of renewable energy projects. The procurement will be done using the Commercial Practices method acceptable to the Bank described in the R2E2 Fund's OM. Particularly: for contracts below US$100,000 equivalent per contract at least two quotations shall be obtained; for contracts below US$1,000,000 equivalent per contract at least three quotations shall be obtained. Where the estimated cost of a contract will exceed a threshold of US$1.0 million, ICB procedure will be followed using the Bank's Standard Bidding Documents In addition, any Direct Contracting under commercial practices shall meet the criteria listed in Bank's Procurement Guidelines provisions 3.6 (a)-(e).

Procurement of non-consulting services: At this stage, it is not foreseen to procure any non-consulting services.

Selection of Consultants: Consulting services under the TA component such as organization of conferences and road shows; dissemination of lessons learned; capacity building; development of by-laws and regulations; hydropower potential utilization plan; comprehensive database etc. will be procured using the Bank's Standard Requests for Proposals and contract forms.

Operating Costs: All operational expenses required for ensuring sufficient operation, such as staff salaries, logistical support, translation, transportation, communication and maintenance costs, office supplies, office rent and utilities which would be financed by the project will be procured using Fund's administrative procedures described in the OM.

The procurement procedures, their thresholds and SBDs to be used for ICB procurement method, are presented in the R2E2 Fund's OM.

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

Procurement activities will be carried out by the R2E2 Fund established by Government Decree no 799 dated April 28, 2005. The Fund is staffed by a director, heating and renewable energy project coordinators, a financial director, and technical staff. The procurement function will be carried out by a procurement specialist responsible for two projects Urban Heating and Renewable Energy.

An assessment of the capacity of the Implementing Agency to implement procurement actions for the project has been carried out on November 15, 2005. The assessment reviewed the organizational structure for implementing the project and the interaction between the project's staff responsible for procurement and the relevant government bodies. The key issues and risks concerning procurement for implementation of the project have been identified and include:

a) involvement in the procurement decision making process (evaluation committee, Project Management Board etc.) of persons that have weak knowledge of the Bank's procurement rules and procedures;

b) The R2E2 Fund's procurement specialist is familiar and has experience with the procurement under the old guidelines, while the project's procurement will be following the new May 2004 Guidelines.

The corrective measures, which have been agreed are (i) list of persons involved in the procurement decision making process under the project shall be included in the Operational Manual and any changes in the list shall be prior agreed with the Bank; (ii) R2E2 Fund's procurement specialist shall receive training on Bank's new procurement Guidelines to update his knowledge.

The Country Procurement Assessment Report (CPAR) has assessed risks (institutional, political, procedural, etc.) that may negatively affect the ability of the implementing agency to carry out procurement and has rated Armenia as a high-risk country. Therefore, the prior review thresholds are those applicable to a high-risk country.

The overall project risk for procurement is high.

C. Procurement Plan

This plan has been agreed between the Borrower and the Project Team on February 7, 2006 and is available at 2 Zakian 2/1, Yerevan Armenia, 375010. It will be also available in the project's database and in the Bank's external website. The Procurement Plan will be updated in agreement with the Project Team annually or as required to reflect the actual 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 Bank offices, the capacity assessment of the Implementing Agency has recommended twice a year supervision missions to visit the field to carry out post review of procurement actions.

A sample of sub-projects will be reviewed annually by the Bank to monitor implementation progress.

E. Details of the Procurement Arrangements Involving International Competition

1. Goods, Works, and Non Consulting Services

At this stage the Procurement Plan does not include any ICB or direct contracting for Goods or Works packages under the project. In case of their future appearance in the project all ICB Goods and Works contracts regardless of their estimated cost and all direct contracting will be subject to prior review by the Bank.

2. Consulting Services

(a) List of consulting assignments with short-list of international firms.

1	2	3	4	5	6	7
Ref. No.	**Description of Assignment**	**Estimated Cost**	**Selection Method**	**Review by Bank (Prior / Post)**	**Expected Proposals Submission Date**	**Comments**
1.	Field surveys and monitoring of potential renewable resources, including rivers, water reservoirs, water and irrigation pipes and canals to identify financially viable sites, and to update the existing Scheme of Small Hydro Power Development for five marzes	270,000	FB	Prior	Feb 1, 2007	GEF Grant
2.	Assistance to potential investors for project preparation, including preparation of business plans, feasibility studies, and preliminary designs.	200,000	FB	Prior	August 1, 2006	GEF Grant

(b) Consultancy services estimated to cost above US$100,000 equivalent per contract with firms, US$50,000 equivalent per contract with Individual Consultants and all single source selection of consultants (firms) will be subject to prior review by the Bank.

(c) Short lists composed entirely of national consultants: Short lists of consultants for services estimated to cost less than US$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

ARMENIA: RENEWABLE ENERGY

Competitiveness of costs

The financial and economic viability of the Project depends largely on the relative cost effectiveness of small renewable projects and other electricity generation/import alternatives. To assess this, three alternatives to small renewables available for Armenia have been considered:

1. Combined-cycle gas thermal (CCGT) plant: Based on the costs of the new CCGT unit that will be constructed in Armenia through JBIC financing (including investment costs of US$750/kW) the tariff of such a plant at non-subsidized cost of capital and gas price (US$130/1000 m^3 at the border)[18] will be around USc 6.0/kWh. If internationally available lowest investment costs (US$500-600/kW) for CCGT plants and lower gas price are used the resulting tariff will be USc 4.0-5.0/kWh.

2. Large hydropower plant: The tariff of a new large hydropower plant in Armenia is assessed at around USc 5.5-6.5/kWh. This is based on investment cost of US$1,200/kW, the minimum cost for Armenia since the development of a large hydropower project involves construction of dams and tunnels; and a construction period of 3 to 5 years.

3. Electricity import: All of Armenia's neighbors are net importers of electricity. Electricity may be imported from Russia, which has presently excess capacity. Presently, the electricity tariff that Russia charges on its exports to neighboring countries is around USc 2.5-3.0/kWh, but these tariffs are highly subsidized and are not expected to be sustained at these levels. Hence, if Russia exports electricity to Armenia, the tariff is likely to be within the USc 3.5-4.0/kWh range.

Table 5 below provides summary information of renewable tariffs and the alternatives discussed above.

Table 5 Relative Costs of Different Generation Alternatives (US c/kWH)

WPP	7.0
Large hydropower*	5.5-6.5
Run-of the river SHPP	4.5
CCGT plant*	4.0-5.0
Electricity import	3.5-4.0
SHPP on artificial water flows	2.0-3.5

* These are based on the aforementioned assumptions

Thus, generation costs of run-of-the-river SHPPs and SHPPs on artificial water flows are competitive with alternative costs of electricity. The generation costs for WPPs are less competitive; however wind resources are expected to make up only a tiny fraction of the total energy generation and are supported because they contribute towards a "renewable obligation", as has been the case in many other countries. Also, the investment costs for WPPs are expected

[18] This is based on 2004 prices.

to decline making them more competitive in the future. Furthermore, since the financing will be made available to sub-borrowers on non-concessional (market) terms, the sub-projects may qualify for the sale of emission credits (through the CDM). During Project implementation each sub-project will be evaluated to determine whether it meets the CDM requirements, including additionality, eligibility (in case it receives GEF, ODA or government assistance), etc. While some sub-projects may not meet CDM requirements, many of them are expected to meet them. The emission credits should provide an additional revenue stream to project developers and allow implementation of otherwise marginally attractive renewable projects.

Financial analysis

The Project is demand driven: the first year portfolio of likely projects has been identified as part of the Project preparation activities and the portfolio for later periods will be identified during implementation. Therefore, the economic and financial analysis of the Project is based on framework-type projects.

To assess the financial viability of the small renewable projects that will receive financing under the Project three types of projects have been analyzed: (i) run-of-the river SHPP; (ii) SHPP on artificial water flows; and (iii) WPP. These three types of renewable projects are currently the most competitive due to the existing tariffs and investment and recurrent costs (see Annex 1 for details), and therefore they are expected to constitute most of the portfolio of projects to be financed through the Project as well as through the additional funds that will be leveraged.

The following are key assumptions underlying the financial analysis for all three types of projects:

- Installed capacity: 1 MW
- Useful life of investments: 20 years
- Discount rate: 10%
- Profit tax: 20%

In addition, since there is an obligation guaranteeing 100 percent purchase of electricity for small renewables, the plant factor is assumed to be the only constraining factor for generation and sales for the projects.

(i) Run-of-the-river SHPP

The existing tariff of US 4.5 cent/KWh is assumed to remain unchanged till the end of the useful life of investment. The investment costs and the plant factor for this type of project vary considerably but for competitive projects they average US$500/kW and 35 percent respectively. Based on these assumptions the FRR of an average project is estimated at 21 percent and the NPV at around US$400,000. These estimates are quite sensitive to changes in the investment cost and the plant factor, with each 10 percent change in the investment cost leading to a 2 percent change in the FRR and each 1 percent change in the plant factor leading to a 1 percent change in the FRR.

Table 6 FRR and NPV of a run-of the river SHPP under different assumptions of investment costs and plant factor

	Investment cost (US$/kW)	Plant factor	Investment cost (US$/kW)	Plant factor	Investment cost (US$/kW)	Plant factor	Investment cost (US$/kW)	Plant factor
	400	35%	500	35%	600	38%	700	40%
FRR (%)	22%		17%		16%		15%	
NPV (US$)	350,740		262,759		255,593		221,579	

* Highlighted columns are the baseline assumptions of the analysis.

Since the financial returns under the base scenario are quite high they remain robust if the change in the investment cost and/or the plant factor is not very significant. The project becomes financially non-viable if the investment cost increases twice or the plant factor falls below 25 percent.

(ii) SHPP on artificial water flows

Tariffs for hydropower projects on artificial water flows, i.e. those built on drinking water or irrigation pipes or canals are set by the PSRC based on cost-plus principle. According to the PSRC Resolution on Tariff Methodology for SHPPs on Artificial Water Flows tariffs allow for 20 percent return on net book value of assets and 5 percent depreciation. Based on this Methodology the FRR and the NPV are assessed at 15 percent and US$55,297 respectively, and they remain the same under different scenarios of investment costs and plant factor. Assuming investment cost of US$200/kW and plant factor of 50 percent, the generation tariff becomes around US 2.0 cent/kWh.

(iii) WPP

The tariff for WPP is currently set at US 7.0 cents/KWh and is assumed to remain unchanged till the end of the useful life of investment. There are significant differences between the wind potential of different sites in Armenia. The baseline scenario is based on the assumption of US$1,000/kW investment costs and 35 percent plant factor; these assumptions are in line with the characteristics of an average technically and financially viable WPP. These assumptions yield FRR of 15 percent and NPV of around US$350,000. The sensitivity analysis reveals that each 10 percent change in the investment cost leads to 2 percent change in the FRR and each 1 percent change in the plant factor leads to 1 percent change in the FRR.

Table 7 FRR and NPV of a WPP under different assumptions of investment costs and plant factor

	Investment cost (US$/kW)	Plant factor	Investment cost (US$/kW)	Plant factor	Investment cost (US$/kW)	Plant factor	Investment cost (US$/kW)	Plant factor
	900	37%	1,000	35%	1,100	33%	1,200	31%
FRR (%)	18%		15%		12%		10%	
NPV (US$)	517,496		346,256		175,017		3,778	

* Highlighted columns are the baseline assumptions of the analysis.

Depending on the target financial rate of return of the investors, WPPs with investment requirements below $1000/kW and plant factor of around 35 percent are financially viable; higher investments and/or lower plant factors may make them non-viable.

Thus, all three types of renewable projects above are financially viable with high FRRs and healthy cash flows. The table below provides a comparative analysis for the three projects.

Table 8 Key assumptions and financial indicators for the three projects:

	Run-of the river SHPP	SHPP on artificial water flow	WPP
Investment cost	US$500/kW	US$300/kW	US$1,000/kW
Plant factor	35%	50%	35%
Tariff (VAT exclusive)	4.5 cent/kWh	2.2 cent/kWh	7.0 cent/kWh
Profitability index (NPV/Investment)	53%	28%	35%
FRR	17%	15%	15%
Payback period	4.5 years	5.5 years	6.5 years

The removal of remaining legal and regulatory, informational, institutional and other barriers for the development of renewables should lead to further improvement of financial returns with concurrent reduction of risks. This should ensure the involvement of private sector in the renewable business, generate adequate deal flow and enable the R2E2 Fund, CC as well as local FIs to leverage additional funds for investments in renewables.

Economic analysis

The economic viability of the Project has been assessed based on cost-benefit analysis. The same assumptions of investment costs, plant factors and tariffs used for financial analysis are used for the purposes of economic analysis with the following additional assumptions:

- The available funds will be allocated only to the three types of project discussed above with the following proportions: 50 percent to run-of the river SHPPs, 30 percent to SHPPs on artificial water flows, and the remaining to wind power generation;
- Loans will be extended in a revolving mode;

- Project developers will be required to put up a minimum of 30 percent as equity co-financing.

The total amount of financing raised for on-lending from IDA, EBRD and CFF is expected to be around US$15 million. This amount together with the equity co-financing of project developers would make about US$21 million available for financing small renewable projects. The TA supported through the Project and early sub-projects is expected to create an enabling environment for the development of small renewable projects, demonstrate their technical and financial viability and lower perceived risks. This together with the revolving nature of the funds should allow leveraging additional funds. The total funding mobilized for small renewable projects during the project life of five years is estimated at US$42 million with the related addition of roughly 80MW of new renewable capacity in Armenia.

Based on the aforementioned assumption this funding will generate net economic benefits of around US$30 million and an ERR of 17.1 percent. The economic benefits are estimated based on FRR by adding supplementary value for the exclusion of taxes and for the reduction of carbon dioxide. The latter is calculated assuming that the new renewable generation will replace gas-fired thermal generation.

Table 6 Key indicators of the economic analysis

Average investment size	US$540/kW
Added renewable capacity	78 MW
Total renewable generation	357 GWh
Total CO2 reduction	264 Ktons
Net economic benefits	US$30 million
ERR	17.1%

A number of studies suggest that if the effect of market risks is taken into account the fossil energy generation costs exceed renewable energy generation costs and that adding fixed cost renewables to a fossil generation mix reduces overall generating cost and risk.

Annex 10: Safeguard Policy Issues

ARMENIA: RENEWABLE ENERGY

The project is expected to increase use of renewable energy resources and further reduce dependence of fossil fuels in producing the energy. The project intends to support primarily construction and/or renovation of small hydropower plants (generally - 1 MW capacity), which do not require construction of new dams. The Project also would support construction of wind turbines which would use wind energy for power generation.

The project triggers three Operational Policies: OP 4.01 Environmental Assessment, OP 4.37 Dam Safety, and OP 7.50 Projects on International Waterways.

The project has been placed in environmental screening category 'FI' under the provisions of the World Bank Operational Policy 4.01, 'Environmental Assessment'. Impacts caused by the Project are limited in scope and are site specific. In most cases mitigatory measures can be designed readily. In fact, the potential environmental impacts of the proposed project are expected to be overwhelmingly positive since it will contribute to reduction of the use of fossil fuels, hence the reduced emissions of greenhouse gases into atmosphere.

The majority of investments will take place on the rivers which qualify for international waterways as per definition provided in OP 7.50.Therefore, the riparian Governments were notified about the proposed project and given a reasonable time to express their concerns, if any. Two riparian states responded to this notification. One of these states raised objection to the Project on the grounds that: (i) Armenia is not party to the Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes, and its Water and Health Protocol, and as a result has no binding international commitments to carry out the use and protection of international water resources in line with international standards; and (ii) Armenia contaminates Araks and other rivers and the water of these rivers is used by their population located down-stream of these rivers for drinking and irrigation purposes. The other riparian state suggested that the Project activities be coordinated with GEF funded and UNDP implemented project on Reducing Trans-boundary Degradation in the Kura/Araks river basin. In response to this letter the World Bank independent environmental safeguards specialist once more reviewed the Project and re-confirmed that the design and proposed implementation arrangements of the Project will not create adverse environmental impacts and will not negatively affect the quality or quantity of the water. Further, the Project team committed to provide information about the Project to the forum of representatives of countries participating in the UNDP/GEF project and to ensure coordination. On the basis of the above the Bank management decided to proceed with the Project processing as scheduled.

Probability of affecting natural habitats of endangered plant and animal species is limited. Nevertheless, each subproject will undergo an environmental screening procedure in order to check for existence of sensitive habitats and any other potential environmental issues.

For each subproject the borrower will have to prepare a subproject specific Environmental Impact Assessment Report and/or Environmental Management Plan (as appropriate) describing the issues and ways to avoid or mitigate the negative impact. This is also a requirement of Armenia Water Code of June 4, 2002, which sets the conditions for issuing the

water use permits. The provisions for addressing environmental issues will be included into bidding documents.

Direct Impact. Potential direct adverse environmental impacts of project activities will be predominantly related to construction activities and will be limited in scope. Most of the small hydropower plants will be built either directly in the river streams or on the pipelines, and will not require construction of dams. Most of the construction will be greenfield operations, while some of them may be just rehabilitation of existing power plants. The Project also may support several investments into development of wind turbines. These will be built in mountainous areas abundant in wind resources, with little vegetation. The potential direct impacts may include the following:

- Damage to ecosystems, habitats or endangered plant species due to dramatically altered water regime in the rivers, caused by construction of the small hydropower plants;

- Damage to ecosystems, habitats or endangered plant species as a result of pipeline trenching/placing of windmills;
- Inhibition of fish migration to spawning sites;
- Noise pollution from a variety of construction works and operation of hydropower- and wind turbines;
- Pollution of soil at construction sites through oil spillage;
- Visual impacts resulting from the windmills;
- Injuries to contractors' workers if applicable safety and occupational health standards are not observed.

Indirect negative environmental impacts of the project may include the following**:**

- Pollution caused by poor disposal of waste materials
- Soil erosion as a result of poor top soil management in pipeline construction
- Reduced amenity values arising from poor remediation of disturbed areas

Proposed Mitigation Measures: The mitigation measures outlined below will be undertaken as part of the project implementation process to mitigate potential impacts from construction activities. These impacts are localized, limited in their scope, short in duration and can be addressed through both design and monitoring measures. The Environmental Management Plan, prepared by the Borrower, summarizes the impacts and mitigation measures, as well as monitoring and supervisory responsibilities. In general, the key mitigation measures include but are not limited to the following:

(i) Preparation of subproject specific Environmental Impact Assessment Report and/or Environmental Management Plans at detailed design phase, which would identify potential environmental issues and specific mitigation;

(ii) Inclusion requirement for the measures to mitigate adverse environmental impacts in bidding documents to be included in bidders proposals;

(iii) Selection of optimal routes for new pipelines, and optimal location of construction sites for hydropower- and wind - turbines, to minimize negative environmental and social impact;

(iv) Ensuring that the fish migrating to spawning sites by-passes the turbines;

(v) Identification of designated landfill sites for waste disposal;
(vi) Adherence to designated working hours to minimize nuisance from construction noise;
(vii) Proper maintenance of construction equipment to minimize pollution and noise;
(viii) Development (and adherence to) safe working procedures;
(ix) Storage of waste (pending disposal) in designated areas in order to minimize risk of injury to workers and others;
(x) Proper use of protective equipment in the event that asbestos or heavy metal containing materials are encountered;
(xi) Separation of topsoil and subsoil during pipeline trenching, with replacement of topsoil after pipe-laying, in order to minimize soil erosion and promote vegetation remediation;
(xii) Cessation of works (to allow suitably qualified experts to evaluate the site) should archaeological or cultural artifacts be found.

If the proposed mitigation measures are implemented, it is not foreseen that the planned project will have any significant cumulative negative impacts on the environment.

The OP 4.37 Dam safety is triggered because there is a possibility that some water for small hydropower plants may be derived from the reservoirs already controlled by the existing dams (para. 7 of the OP). However, all the dams in Armenia are covered by the on-going Irrigation Dam Safety 2 Project which is aimed at ensuring required minimum safety standards at all the existing dam controlled reservoirs in the country. Therefore, for purposes of the Renewable Energy project the Borrower was not asked to arrange for one or more independent dam specialists to conduct reviews, evaluations and provide with recommendations as per provisions of para.8 of the Policy. If deemed necessary, the required information about the status of the dam in question will be obtained from the team implementing the Irrigation Dam Safety 2 Project.

Annex 11: Project Preparation and Supervision

ARMENIA: RENEWABLE ENERGY

	Planned	Actual
PCN review		10/14/2004
Initial PID to PIC		12/22/2004
Initial ISDS to PIC		12/22/2004
Appraisal	10/28/2005	12/30/2005
Negotiations	02/10/ 2006	02/10/2006
Board/RVP approval	03/30/ 2006	
Planned date of effectiveness	05/30/ 2006	
Planned date of mid-term review	09/15/2008	
Planned closing date	12/31/ 2010	

Key institutions responsible for preparation of the project:

Ministry of Energy
Ministry of Finance and Economy
Renewable Resources and Energy Efficiency Fund

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Gevorg Sargsyan	Sr. Infrastructure Specialist (Task Team Leader)	ECSIE
Bjorn Hamso	Sr. Energy Economist (PTL)	ECSIE
Andrina Ambrose	Sr. Finance Officer	LOAG1
Junko Funahashi	Sr. Counsel	LEGEC
Alexander Astvatsatryan	Procurement Specialist	ECSPS
Inesis Kiskis	Sr. Environmental Specialist	ECSSD
Satoshi Ishihara	Social Development Specials	ECSSD
Arman Vatyan	Financial Management Specialist	ECSPE
Ani Balabanyan	Operations Analyst	ECSIE
Surekha Jaddoo	Operations Analyst	ECSIE
Stratos Tavoulareas	Consultant (Energy/Env. Economist)	ECSIE
Carlo Segni	Consultant (Financial Sector Specialist)	ECSPF
Josephine Kida	Program Assistant	ECSIE

Bank funds expended to date on project preparation:
GEF: $57,925
Bank Budget: $75,364
Total: $133,289

Estimated Approval and Supervision costs:

1. Estimated annual supervision cost: $ 90,000

Annex 12: Documents in the Project File

ARMENIA: RENEWABLE ENERGY

- Minutes of Project Concept Note Review meeting
- Minutes of Quality Enhancement Review meeting
- Commitment letter from Cafesjian Family Foundation
- Minutes of Decision meeting
- Minutes of Renewable Energy Conference
- Environmental Management Plan
- Web Accessible Renewable Energy Data Base of Armenia.
- Renewable Energy Geographical Information System of Lori region
- Development of "One-stop-Shop" Concept for the Implementation of Renewable Energy Projects in Armenia
- Recommendations to Remove the Barriers for Development of Renewable Energy in Armenia
- Assessment of the Local Production Potential in Armenia for Market-ready Segments of Renewable Energy
- Renewable Energy Projects Initial Portfolio Building for Renewal Resource Revolving Fund

Annex 13: Statement of Loans and Credits

ARMENIA: RENEWABLE ENERGY

Project ID	FY	Purpose	Original Amount in US$ Millions				Cancel.	Undisb.	Difference between expected and actual disbursements	
			IBRD	IDA	SF	GEF			Orig.	Frm. Rev'd
P093459	2006	AM -PRSC 2	0.00	20.00	0.00	0.00	0.00	20.43	0.00	0.00
P087011	2006	RUR ENT & AGRIC DEVT	0.00	20.00	0.00	0.00	0.00	18.51	-0.75	0.00
P057880	2006	URBAN HEAT	0.00	15.00	0.00	0.00	0.00	14.49	0.00	0.00
P087641	2005	YEREVAN WATER/WW SERVS	0.00	20.00	0.00	0.00	0.00	16.62	5.03	0.00
P074503	2004	EDUC QUAL & RELEVANCE (APL #1)	0.00	19.00	0.00	0.00	0.00	15.13	3.84	0.83
P073974	2004	HEALTH SYS MOD (APL #1)	0.00	19.00	0.00	0.00	0.00	17.38	8.17	1.20
P088499	2004	IRRIG DAM SAFETY 2	0.00	6.75	0.00	0.00	0.00	5.90	0.37	0.00
P063398	2004	MUN WATER & WW	0.00	23.00	0.00	0.00	0.00	15.87	3.94	0.00
P060786	2004	PUB SECT MOD	0.00	10.15	0.00	0.00	0.00	9.29	2.54	0.00
P087620	2004	SOC PROT ADMIN	0.00	5.15	0.00	0.00	0.00	4.87	1.50	0.00
P044852	2002	ENT INCUBATOR LIL	0.00	5.00	0.00	0.00	0.00	2.41	1.68	0.92
P055022	2002	IRRIG DEVT	0.00	24.90	0.00	0.00	0.00	10.89	5.10	0.00
P057847	2002	NAT RES MGMT	0.00	8.30	0.00	0.00	0.00	7.06	1.03	0.00
P069917	2002	NAT RES MGMT (GEF)	0.00	0.00	0.00	5.12	0.00	3.85	0.83	0.00
P057838	2001	JUDICIAL REFORM	0.00	11.40	0.00	0.00	0.00	1.75	-0.27	0.00
P008276	1999	ELEC TRANSM & DISTR	0.00	21.00	0.00	0.00	0.00	1.06	0.38	0.30
P064879	1999	IRRIG DAM SAFETY	0.00	26.60	0.00	0.00	0.00	8.39	8.06	2.13
		Total:	0.00	255.25	0.00	5.12	0.00	173.91	41.47	5.37

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

FY Approval	Company	Committed IFC				Disbursed IFC			
		Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
2002	ACBA Leasing	2.00	0.27	0.00	0.00	2.00	0.27	0.00	0.00
2004	Armeconombank	2.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
2000	Hotel Armenia	0.00	0.00	3.57	0.00	0.00	0.00	3.57	0.00
2004	Hotel Armenia	0.00	0.00	1.25	0.00	0.00	0.00	1.25	0.00
	Total portfolio:	4.00	0.27	4.82	0.00	4.00	0.27	4.82	0.00

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

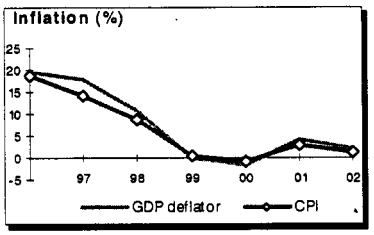
Annex 14: Country at a Glance

ARMENIA: RENEWABLE ENERGY

Armenia

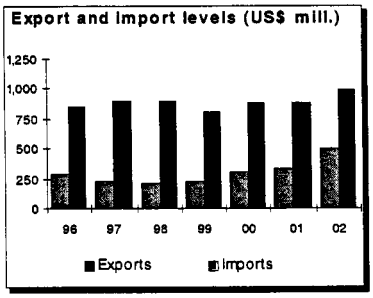
PRICES and GOVERNMENT FINANCE

	1982	1992	2001	2002
Domestic prices				
(% change)				
Consumer prices	..	728.7	3.1	1.1
Implicit GDP deflator	..	568.8	4.0	2.3
Government finance				
(% of GDP, includes current grants)				
Current revenue	..	4.0	16.3	16.7
Current budget balance	..	-7.7	0.3	0.5
Overall surplus/deficit	..	-7.7	-4.3	-2.6



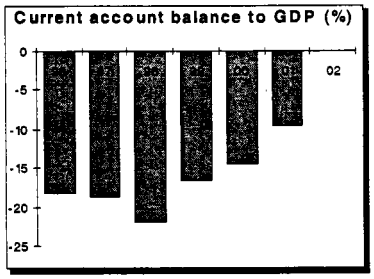
TRADE

	1982	1992	2001	2002
(US$ millions)				
Total exports (fob)	..	220	342	507
Gold, jewelry, and other precious stones	..	..	123	259
Machinery and mechanical equipment	..	..	28	21
Manufactures	..	..	89	..
Total imports (cif)	..	334	877	991
Food	..	..	211	200
Fuel and energy	..	60	187	..
Capital goods	..	..	62	..
Export price index *(1995=100)*	..	..	..	..
Import price index *(1995=100)*	..	..	..	..
Terms of trade *(1995=100)*	..	..	..	..



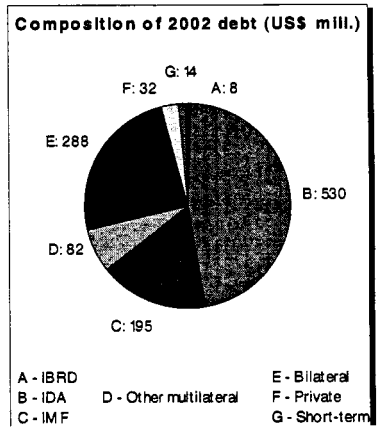
BALANCE of PAYMENTS

	1982	1992	2001	2002
(US$ millions)				
Exports of goods and services	..	230	540	700
Imports of goods and services	..	364	978	1,117
Resource balance	..	-135	-438	-417
Net income	..	-39	64	88
Net current transfers	..	..	174	169
Current account balance	..	..	-201	-160
Financing items (net)	..	..	217	234
Changes in net reserves	..	..	-16	-73
Memo:				
Reserves including gold *(US$ millions)*	..	..	334	360
Conversion rate *(DEC, local/US$)*	..	0.3	555.1	573.4



EXTERNAL DEBT and RESOURCE FLOWS

	1982	1992	2001	2002
(US$ millions)				
Total debt outstanding and disbursed	..	..	989	1,149
IBRD	..	..	7	8
IDA	..	..	428	530
Total debt service	..	..	55	74
IBRD	..	..	1	1
IDA	..	..	3	4
Composition of net resource flows				
Official grants	..	..	42	0
Official creditors	..	..	59	63
Private creditors	..	..	0	-4
Foreign direct investment	..	..	70	0
Portfolio equity	..	..	0	0
World Bank program				
Commitments	..	..	75	9
Disbursements	..	..	55	66
Principal repayments	..	..	0	0



Annex 15: Incremental Cost Analysis

ARMENIA: RENEWABLE ENERGY

Introduction

Armenia has a total of 3,196 MW installed capacity consisting of 408MW nuclear, 1,032MW hydropower and 1,756 MW thermal power plants burning natural gas. Presently, Armenia has sufficient electricity generating capacity to meet electricity demand, but new capacity is high priority, as demand (expected to grow at 2-3 percent annually) will outstrip supply when the 400 MW nuclear plant may end its operating life. Also, electricity supply is affected by aging and deteriorated thermal and hydropower plants; 70 percent of the country's hydropower plants are more than 35 years old and 50 percent are more than 50 years old.

Following a severe energy crisis in 1992-94, Armenia has achieved remarkable results in reforming the power sector. It has restored round-the-clock supply of electricity, brought the tariffs to cost-recovery levels and successfully privatized the majority of the energy sector assets, including the electricity distribution network. A strong regulator plays an important role in the sector. With reforms steadily improving the sector financial performance, sector efficiency and quality of power supply, the key remaining challenge is to ensure sustainable and reliable power supply by: (a) shifting reliance from costly sources of energy (e.g., electricity for heating) to lower cost alternatives (home insulation, gas, solar heating); (b) increasing energy diversification and achieving a higher degree of energy self-sufficiency through the utilization of indigenous renewable energy resources.

Armenia has significant renewable energy resources, but they play a limited role in the country's energy supply. Approximately 740 MWs of small hydropower, wind and geothermal resources have been identified, which, if implemented, would represent 25 percent of the present installed capacity. Hydropower and some of the wind resources are estimated to be most attractive. Over 250MW of capacity could be added through small hydropower projects (SHPPs) that are competitive with other forms of new generation. Commercially viable grid-connected wind power projects (WPP) with total capacity of 195MW and annual generation of 0.55 GWh have been identified based on site-specific assessments carried out in some parts of the country, too.

The existing legal and regulatory framework in Armenia is generally supportive to the development of renewables. Among others, it guarantees the off-take of 100 percent of electricity generated by small renewable plants at tariffs set by the PSRC and provides payment assurance. A resolution of the PSRC set attractive tariffs for newly constructed run-of the river SHPPs (USc 4.5/kwh), wind and biomass (USc 7.0/kwh) till 2016.

However, there are a number of barriers which keep most of these projects from materializing including:

- High capital outlay and preparation costs for small renewable projects;
- Limited access to long-term finance and management capacity constraints;
- Unfamiliar risk profile of borrowers and related perception of high risk for renewable energy projects;
- Lack of experience of project sponsors, local FIs and engineering and consulting industry with renewable technologies and the appropriate project structures;

- Legal and regulatory barriers with gaps in regulations; long and often non-transparent process for obtaining the necessary permits, licenses and other required approvals; and tariffs for existing and newly constructed SHPPs operating on artificial water flows requiring further improvements to eliminate uncertainties and attract project financing;
- Lack of reliable information about potential sites for renewable energy projects.

Rationale for GEF involvement

The justification of this project for GEF participation is based on removal of barriers and enabling mobilization of financing from IDA, EBRD and CCF. GEF funding ($3 million) is directed to the removal of barriers to create a sustainable renewable energy market in Armenia and assistance in preparation of renewable energy projects. Without GEF participation, private developers may not be able to develop and finance projects that benefit project partners and the country at large. Also, without GEF, there would be a lack of resources to build knowledge about renewable energy among private investors, FIs, policy-makers, and other stakeholders. GEF support will lead to sustainable financing of renewables resulting in long-term reductions of greenhouse gas emissions.

As a result of GEF participation, 180MW of additional renewable projects are expected to be implemented and approximately US$140 million investment be leveraged.

In addition, the Bank and GEF involvement is essential to add creditworthiness to the R2E2 Fund and enhance its ability to replenish and leverage other financing, particularly from EBRD as well as from the Armenian Diaspora without sovereign guarantee.

The following sections describe the baseline (without GEF) and alternative (with GEF) scenarios, along with the corresponding global and local benefits due to the alternative scenario, and the cost-effectiveness of greenhouse gas reductions.

The baseline scenario

The baseline scenario is without GEF support. As elaborated in Annex 1 of the PAD (Country and Sector or Program Background) and the Project Executive Summary, presently Armenia's power sector relies on hydropower, nuclear and thermal power. The generation contributed by these sources varies; nuclear depends on the plant availability, while hydropower on rainfall. Thermal power (mostly old and inefficient plants burning natural gas) contributes 25-50 percent after nuclear and hydropower have contributed their maximum energy. However, in the near future (uncertain yet, but expected in the 2008-12 timeframe) the nuclear plant will be retired. New capacity to replace this plant, as well as meet growing electricity demand, would come from new power plants (CCGTs) burning natural gas and renewables.

While there are significant renewable resources available, most of them are not expected to be implemented due to the barriers stated above. Some renewable projects will be implemented as a result of GOA's reforms and financing from KfW of Germany (approximately US$7 million allocated). The total investment in renewable projects that would be implemented under the baseline scenario (without GEF support) is estimated at US$12 million financed by KfW and

some private investments. This will add roughly 20MW of capacity in the next 5 years. An additional 20MW capacity is estimated for the following 15 years requiring an investment of $20 million. In addition, KfW will provide about US$1 million to assist in preparation of sub-projects financed by KfW and capacity building of a limited number of banks that will participate in its program.

This limited renewable development will be due to the barriers and risks inhibiting or delaying their implementation (see Annexes 1 and 4 for detailed description of the barriers). Also, even if some of the renewable projects materialize without GEF support, they are expected to take longer to be implemented (compared to the alternative scenario below, with GEF intervention), cost more per kW of installed/available capacity and not utilize modern and efficient technologies. For example, there have been cases where a SHPP utilized used water pumps operating in reverse mode instead of buying a more efficient hydropower turbine; while reducing project investment costs, this greatly compromises the plant efficiency and associated greenhouse gas reductions. Finally, the capacity of the industry (consulting, engineering, manufacturing and construction) is another limiting factor.

Greenhouse gas reduction benefits: The greenhouse gas reduction resulting from the renewables built under the baseline scenario (estimated to be 20MW the first five years and an additional 20MW for the remaining 15 years) would result in 1.4 million ton of CO_2 emission reductions over 20 years. This assumes approximately 2,000 tons CO_2/yr-MW based on the emission factor of 650kg/MWh and plant factor of 35 percent[19].

GEF Alternative Scenario

Under the alternative scenario, GEF support is expected to remove most of the existing barriers and reduce the impact of others; thereby making some of renewable projects viable and enhancing the sustainability of renewable resources in Armenia.

The Project will include the following components:
A. *Technical assistance to remove barriers and support project implementation (US$3.7 million, of which US$3 milllion from GEF).* This component covers the following areas:

1. Improvement of legal and regulatory framework and capacity building for state agencies (US$0.5 million): (a) revising the existing legislation and regulations to improve and streamline procedures for transparent and fair allocation of resources (e.g. land rights, water permits, and licenses); (b) developing sub-legislation to operationalize the law on renewable energy and energy efficiency, (c) reviewing and amending the rules of acceptance for small renewable generation for the system operator, (d) strengthening the capacity of the PSRC, the Ministry of Energy (MOE), State Water Committee, and Meteorological Service.

2. Support in facilitating investments in renewable sub-projects (US$2 million): (a) TA and capacity building to local FIs, private investors, local engineering and consulting

[19] It is expected that the renewable generation will replace some of the generation by the thermal plants, which account for over 30% Armenia's power generation. The thermal plants are based on old technology and have a very low level of efficiency with natural gas consumption of 375-380 grams/kWh.

industry, including information and incentives about new renewable energy technologies and associated benefits; (b) developing a comprehensive database of renewable energy resources, with a related open source Geographic Information System (GIS), and a web portal for identification, assessment, and monitoring of potential renewable energy projects; (c) field survey of potential sites; (d) establishing a one-stop-shop for potential investors to facilitate the process of obtaining required permits, licences, and other documents; (e) TA to potential investors for project preparation activities, such as business plans, feasibility studies, and preliminary designs.

3. Mechanisms to leverage additional financing (US$0.44 million): assistance will be provided to the R2E2 Fund to prepare a long-term strategy for the mobilization of additional financing for developing renewable energy, including: (a) roadshows and conferences for potential investors; (ii) design and piloting of different financial instruments to accelerate lending to sub-borrowers, replenish funds and enhance the leveraging impact of the Project. These instruments may involve risk sharing arrangements like partial risk guarantees, or asset backed securities, such as bonds or other suitable marketable instruments secured against the portfolio of renewable projects by the R2E2 Fund.

4. Project implementation and monitoring (US$0.76 million): (a) TA, equipment, and logistical support to implementing agencies for project implementation, monitoring, supervision, collection and dissemination of lessons learnt; (b) institutional support to the R2E2 Fund to act as an umbrella institution for CDM transactions[20].

B. Financing of investments:

As a result of GEF participation during the initial five years, approximately 80MW of small renewable capacity will be built requiring an investment of $42 million in addition to what is projected for the baseline (US$5 million from IDA, US$7 million from EBRD, US$3 million from CFF, and US$ 27 million from private investors, local FIs and revolving of funds), which are not expected to participate without GEF; 40MW capacity will be added due to Component A (Technical Assistance to remove barriers and assist in project preparation) and 40MW additional capacity due to the combination of Components A and B (TA and Direct Investment in projects). Approximately 50 percent of the projects will be new run-of the river SHPPs, 30 percent will be SHPPs on artificial water flows, and the remaining will be WPPs. SHPPs on artificial water flows are estimated to cost US$150-350/kW (mean value: US$300/kW), run-of-the-river SHPPs are estimated to cost US$400-800/kW (mean value: US$500/kW), and WPPs are estimated to cost in the range of US$900-1200/kW (mean value: US$1,000/kW).

Projects which are expected to be implemented under the alternative scenario include:

- Rehabilitation and upgrading of existing SHPPs;
- New run-of-the-river SHPPs;
- New SHPPs on artificial water flows (drinking water and irrigation pipes and canals);
- WPPs; and

[20] CDM capacity-building will be funded by GOA

- Other renewables, which could not be implemented without the removal of the stated barriers or due to marginal cost-effectiveness and financial viability.

After the initial five years, additional SHPPs and WPPs with 100 MW of capacity are expected to be built from the interest earned by the R2E2 Fund and CC, as well as the re-paid principal and leveraged financing. This would require an investment of US$100 million, of which approximately US$30 million will come from re-paid principal and interest earned and the remaining US$70 million from project sponsors and other financial sources.

These projects represent additional investments of US$142 million that would not have materialized without the removal of barriers supported by GEF and the funding by the R2E2 Fund.

Greenhouse gas reduction benefits: Under the Alternative (with the project) scenario, the greenhouse gas reduction will increase (above and beyond the baseline level) by 6.2 million tons of CO_2 over a 20-year period:

- 3.2 million tons CO_2 over a period of 20 years (160,000 tons CO_2/yr) from the 80MW capacity built in the initial five years of the R2E2 Fund operation; and
- 3.0 million tons of CO_2 emission reductions over a 15-year period from the 100MW capacity built after the initial five years of the R2E2 Fund operation.

Under a more optimistic scenario, assuming emission factor of 720kg/MWh and plant factor of 40 percent (yielding greenhouse gas reduction of 2,500 tons CO_2/yr-MW), the additional cumulative reductions brought by the GEF project case will amount 7.75 million tons of CO_2.

Local Benefits: This includes: (i) reduction in local pollution (mainly NOx emissions from natural gas-fired power plants); (ii) employment in rural areas; (iii) reduction of the country's vulnerability associated with the reliance on unstable supply of fuel; (iv) contribution to the GOA's policy to diversify electricity generation and increase energy security; (v) reduction of foreign exchange requirements associated with the purchase of natural gas; (vi) facilitation of private sector development.

Also, the project will have a positive impact on Armenia's consulting and manufacturing industry, as well as the financial sector. The R2E2 Fund will actively seek co-financing from other FIs. The project will build the institutional capacity and know-how in planning, assessing, and financing renewable projects. Also, the private sector would be interested and will have the experience to develop renewable energy projects. Finally, new financial instruments will be available, such as partial risk guarantee, asset backed securities, etc.

Incremental Costs and Benefits

A summary of the costs and benefits is presented also in the following Table. Since GEF will contribute US$3 million, the unit abatement cost works out to US$0.48 per ton of CO_2 removed.

Table: GEF Incremental Cost Matrix

	Baseline	Alternative	Increment
Domestic Benefits	Barriers to renewable projects contribute to local pollution from thermal power plants.	Lower local pollution	Increased investment in renewables reduces local pollution.
	The country relies heavily on imported fossil fuels for its electricity supply with resulting vulnerability of Armenian economy to fuel supply disruptions and price fluctuations.	Increased diversification of electricity supply and energy security.	Higher share of renewable energy in total generation.
	Private sector and local FIs are reluctant to finance renewable energy projects due to the high risk and unfamiliar profile of the business.	Investments in renewables by the private sector and local FIs.	Increased investments in renewables by the private sector and local FIs.
	Weak capacity of local organizations (e.g. consulting and engineering industry) to develop and finance renewable projects.	Competent and strong consulting and engineering industry results in lower cost of project preparation and implementation and utilization of more efficient technology.	Increased capacity to develop renewable projects.
Global Benefits	Baseline level includes a limited number of renewable projects (20MW in the first five years and 20MW more in the next 15 years) reducing 1.4 million tons of CO_2.	Development of 100MW of small renewable projects[21] during the first 5 years. Revolving funds and private sector finance 120MW[22] in the remaining 15 years. The resulting emission reductions over a 20-year project life are: Projects from first 5 years: 4.0 million tons of CO_2 Projects from the next 15 years: 3.6 million tons of CO_2 Total CO_2 reduction: 7.6	The alternative scenario (compared to the baseline) Additional 80MW of small renewables during the first five years and 100MW during the next 15 years with resulting additional 6.2 million tons of CO_2 emissions.

[21] Including the 20 MWs assume
d for the baseline

[22] Including the 20 MWs assumed for the baseline

		million tons.	
Cost by activities	**Figures in US$**	**Figures in US$**	**Figures in US$**
Improvement of legal and regulatory framework and capacity building for state agencies	0	300,000	300,000
Support in facilitating investments in renewable sub-projects	1,000,000	3,150,000	2,150,000
Mechanisms to leverage additional financing	0	440,000	440,000
Project monitoring and dissemination of lessons learnt	0	760,000	760,000
Investment financing • Initial 5 years	12,000,000 financed by KfW and private investors	5,000,000 IDA, 7,000,000 EBRD 3,000,000 CFF 39,000,000 KfW, private investors and FIs	5,000,000 IDA, 7,000,000 EBRD 3,000,000 CFF 27,000,000 private investors and FIs
• Subsequent 15 years	20,000,000 financed by private investors and local FIs	30,000,000 financed from reinvestment of re-paid principal amounts, interests 90,000,000 financed by private investors, FIs, as well as funds leveraged by the R2E2 Fund.	30,000,000 financed from reinvestment of re-paid principal amounts, interests 70,000,000 financed by private investors, FIs, as well as funds leveraged by the R2E2 Fund.
Total Cost:	**33,000,000**	**178,650,000**	**145,650,000**
Including GEF shares and GEF share:	**0**	**3,000,000**	**3,000,000**

Annex 16: STAP Roster Review

ARMENIA: RENEWABLE ENERGY

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Scientific and technical soundness of the project

Questions that could be raised are:

1. Has the most appropriate and effective approach been used to remove the barriers?

Yes. The barriers identified applicable to renewable energy projects identified in the PAD are: High capital outlay and preparation costs, Limited access to long-term finance and management capacity constraints, Unfamiliar risk profile of borrowers and related perception of high risk, Lack of experience, Legal and regulatory barriers, Lack of reliable information about potential sites for renewable energy projects. The PAD provides adequate justification that these are indeed the relevant barriers. The approach taken also appears to be well oriented towards reducing these barriers.

2. Has the most appropriate and effective approach been used to reduce the costs of the technologies?

The costs of the technologies (mainly hydropower and wind power) depend on factors that are not country specific. However, project identification and development costs are indeed country specific and can add a substantial amount to the direct costs of the technologies. The technical assistance components of the proposed project appear to be well oriented to reducing these indirect costs. Quite a substantial part of the proposed budget ($1.6 million) is directed to capacity building and related activities.

3. Was the potential market determined on the basis of RETs data and databases?

The potential market for RETs was determined in previous work, as part of the PDF-B grant, a study sponsored by the US-AID, as well as other studies. These included a "technical and financial feasibility assessment of an initial portfolio of bankable projects." Potential hydropower and wind power projects are listed in the PAD (Annex 1, Tables 2 and 3). Moreover, the project proposes to create an extended data base on renewable energy, based on GIS.

4. Has an evaluation of the demand-side mechanisms to support after sales-service been undertaken?

The technologies for renewable power generation connected to the grid are on the supply side, so that no specific demand-side activities are needed for implementing the proposed projects.

5. Adequacy of the financing mechanism?

The PAD reports that there are guaranteed support prices for renewable electricity so that projects are likely to be profitable for the investors. However, securing initial financing is a problem because of the small and undeveloped capital markets in Armenia. Moreover, loans for individual projects are too small for international FIs. Thus the project proposes the creation of a local FI for providing the loans, with larger-scale financing from the World Bank (IDA), EBRD, and other sources. This mechanism appears to be adequate. A financial institution for renewable energy projects has been shown to be highly successful in India (Indian Renewable Energy Development Authority). Such a specialized bank, with adequately trained staff, could overcome one of the barriers facing the financing of small, renewable power projects: lack of experience of traditional lending institutions. Thus, the financing mechanism proposed appears to be entirely adequate.

6. Adequacy of the introduced financial incentives?

The proposed project introduces no financial incentives in the form of subsidies for renewable power projects. Such subsidies may not lead to the creation of a sustainable infrastructure for renewable energy projects. By focusing attention on reducing barriers and therefore the transaction costs of project identification, financing, and implementation, the proposed project paves the way to sustainability.

Team response: *In addition, the project addresses the liquidity of the financial sector by providing long maturity funds to project developers.*

7. Comments on the design of demonstration project?

The technologies involved are fairly well known worldwide. Thus there is no need for technology demonstration, and the project proposes none. However, the IDA credit component associated with the GEF grant includes financing of a number of renewable power projects. This demonstration of project financing is important to induce other lenders to commit financing to renewable power projects in Armenia, which is an essential component of creating a sustainable infrastructure for project development in the future.

8. Will a process be put in place to monitor the project?

The monitoring parameters and process indicated in Annex 3 appear to be excellent.

9. Is the barrier removal supported by an underlying policy framework?

Armenia already has certain laws and regulations in place that recognize the benefits of, and provide special incentives to, renewable power projects. The technical assistance included in the proposed project includes a component for the improvement of legal and regulatory framework and capacity building for state agencies. This component should help remove institutional barriers to renewable power.

10. Is the proposed activity feasible from an engineering and technical perspective?

The project activities involve the promotion of off-the-shelf technologies for renewable power generation, so that there are no fundamental engineering or technical obstacles. The proposed project includes a significant capacity building component. The training to be provided would enable local technical professionals to implement potential projects.

Identification of global environmental benefits

Global benefits are expressed in reduced emission of green-house gas. However, auxiliary benefits may occur in other areas such as land degradation and biodiversity.

The PAD, Annex 15, Incremental Cost Analysis claims that CO2 emissions reductions from renewable power to be 2,500 tons CO_2/yr-MW, citing a "Memo by PA Governmental Services to The World Bank dated October 30, 2003." This reviewer has made an independent estimate of project economics and emissions reductions, shown below.

Plant capacity	80MW
Plant load factor	0.35 assuming a mix of wind and hydro power
Energy generation	245 GWh per year
Emissions factor	500 kg/MWh
Emissions reduction	122,640 tonnes per year, 2.45 million tonnes in 20 years
Unit investment	400 $/kW assuming more hydropower and less wind power
Direct investments	$32 million
Transactions costs	$ 6.4 million at 20% of direct costs
Total investments	$38.4 million $

Assuming that the renewable power project displaces CCGT power stations, we would expect the emissions factor to be no more than 500 kg/MWh, as shown in the table above. A total capacity of 80 MW would then reduce CO_2 emissions by 122,640 tonnes per year. This is equivalent to 1,533 tCO_2/MW-yr. This is the highest possible emissions factor that may be reasonably considered. Some of the electricity generated by projects supported by this initiative may offset generation from large hydropower, in which case the average emissions factor would be lower than this value. The value of 2,500 tCO_2/MW-yr (given in the PAD, Annex 15: Incremental cost analysis) appears to be excessively high, assuming either low efficiency power plants (e.g. natural gas open cycle gas turbines) or high carbon content fuels (petroleum or coal). The use of these alternative generation technologies is not supported by the documentation presented in this PAD and Annexes. Please check the PA Memo and revise the estimate. Note, however, that even with lower emissions reductions, abatement cost is likely to be quite low (see Annex 15, sub-section of incremental costs), perhaps rising to $1.15 per tCO_2.

Team response: *Emission reductions were estimated assuming that renewable generation will replace some of the generation by the thermal plants, which account for over 30 percent of power generation in Armenia. The thermal plants are based on old technology and have low level of efficiency with natural gas consumption of 375-380 grams/kWh. Therefore, the emission factor of 700kg/MWh was used. In addition, since hydropower*

plants are expected to represent most of the added renewable generation capacity (including hydros on water pipes and canals with capacity factors often close to 100 percent), the average plant factor was assumed 40 percent. However, based on the reviewer's comments the project team will revise the preliminary estimates and use base case scenario with emission factor of 650kg/MWh and 35 percent plant factor. A more detailed assessment of the GHG reduction potential will be carried out during the project preparation and implementation, and will follow Kyoto Protocol and Marrakech Accords procedures/requirements re. CDM projects. Among others, it will be assessed whether new CCGT plants that might be constructed in the future should be used in the base case scenario, in which cases a lower emission factor may need to be used. As the reviewer pointed out, the cost-effectiveness ($/ton of CO2 removed) is still expected to remain quite low. Also, the potential revenues from sale of emission reductions are not included in the financial analysis of this project.

How does the project fit within the context of the Goals of the GEF

Operational Programmes detail the strategic considerations in the focal area and outline the type of activities and approaches GEF supports to address long-term programme priorities of the Conventions to mitigate climate change. Addressing this question requires the knowledge of the Operational Strategy and Programmes of the GEF.

The proposed project fits in perfectly with Operational Program #6: *Promoting the adoption of renewable energy by removing barriers and reducing implementation costs.* GEF Business Plans for FY04-06 and FY05-07 identify four Strategic Priorities. The proposed project is consistent with three of these priorities, and a part of the fourth.

Regional Context

The regional context is generally less relevant in the Climate Change focal area than in Biodiversity and International Waters.

Renewable power generation depends on local resources, and thus the regional context is not relevant except for hydropower projects on rivers that are national boundaries. This issue is mentioned further below in "Secondary issues: Other beneficial or damaging environmental effects." In all other ways the impact of the project in the regional context is highly positive. Armenia imports energy from other countries, and some of this import takes place through countries where there is a potential for conflict. The increased dependence on local energy resources, as a consequence of this project, would reduce the potential impact of supply disruptions arising from foreign suppliers as well as countries through which energy must pass in order to reach Armenia.

Replicability of the project

A key assumption is that a successful market application in one country will be replicated widely in other countries where the same market applications have significant GHG – reduction potential. Therefore, to the degree possible, GEF supports the type of barrier removal mechanisms that are transferable to other countries.

The project design takes into account the experience of other countries —in the region and

elsewhere— in promoting renewable power projects. It is expected that this project would contribute to a growing body of experience that will be available to other countries.

Sustainability of the project

Relates to removing all barriers and not to merely subsidizing. In some instances projects merely surmount a barrier while leaving it in place.

Questions that could be raised:

1. Continuity of the generation systems after the subsidies and the intervention?

There appears to be relatively high purchase prices for renewable power projects. In Annex 1 text prior to Table 2 states: "...attractive tariffs for newly constructed SHPPs operating on natural water flows (4.5 cents/kWh) and wind, biomass and waste (7 cents/kWh) until 2016." This reviewer estimates conventional power generation is likely to be 3 cents/kWh, using natural gas combined cycle power plants, considering relatively low gas prices. Annex 9 provides estimates of CCGT generation for a specific project, to be 6 cents/kWh, considering relatively high gas prices. The PAD mentions elsewhere that, following reforms, the tariffs are cost based. It is not clear where the subsidy or price support for renewable power would come from. If they are from general revenues, this means that other public expenses would be reduced. Alternatively, these subsidies could be based on a carbon tax on, say non-renewable power generation, in which case, the cross subsidy would be limited to the power sector, in effect internalizing externalities associated with imported, non-renewable fuels. While the nature of the cross-subsidy appears to be existing prior to, and therefore not a part of, the proposed project, the PAD should clarify the nature of the subsidy, since it affects sustainability.

Team response: *There are no state subsidies to the power sector and no subsidies are anticipated as a result of the Project. SHPP tariffs are competitive with other forms of generation (with tariffs for SHPPs on artificial water flows below USc 3.5/kWh and tariffs for run-of-the-river SHPPs at USc 4.5/kWh). The weighted average tariff for all the renewable sub-projects to be financed is assessed at USc 4.3/kWh (assuming that the financing will be allocated in the following proportions: 50 percent to run-of-the-river SHPPs, 30 percent to SHPPs on artificial water flows and 20 percent to WPPs), which is comparable to the costs of thermal generation. While the tariffs for some renewables (wind) are not competitive, supporting their implementation is important because they contribute towards a "renewable obligation". Finally, the addition of renewable capacity will be gradual and the contribution to the energy mix in the beginning will be very small; therefore the impact of increasing renewable generation on end-user tariffs will be small, if any. The CCGT generation is estimated at USc 6/kWh since the analysis used a market price for the natural gas in view of the fact that the gas subsidies are not expected to be sustainable and are likely to be removed.*

2. Has an appropriate cost recovery been demonstrated?

Economic and financial analysis adequately demonstrates cost recovery for typical projects. Of course, economics for renewable power projects are site specific, so that the analysis would only be

valid where the natural resource and site conditions are adequate for project development. Adequate cost recovery also requires a power purchase agreement (PPA) with adequate purchase prices for renewable power. This was discussed in the previous point.

3. Has the question of competitiveness been raised?

The question of competitiveness may arise in different contexts. In the first place, the project gives preference to those renewable power technologies that are most likely to be competitive with conventional alternatives (based on fossil fuels, large hydropower or nuclear). Another context is competitive procurement. Procurement arrangements are discussed in Annex 8. In the question of competitive bidding, the proposed project would follow the 2004 World Bank guidelines. These guidelines cover procurement of works, goods, consulting and non-consulting services, etc. These are deemed to be adequate in ensuring transparency as well minimizing overall costs through competition. However, please note that in the reviewed version many of the detailed parameters in Annex 8 are missing. These will need to be completed prior to the finalization of the PAD.
The procurement arrangements will be finalized during the appraisal. The procurement rules will be based on the World Bank rules but will allow sufficient flexibility to reduce transaction cost and preparation time and get low cost.

4. Has the project taken an approach that stresses continuity for the institutional logistics development?

A significant part of the GEF budget ($400,000) focuses on "Improvement of legal and regulatory framework and capacity building for state agencies." The specific activities to be supported in this category are well oriented towards promoting institutional continuity.

5. Have issues of ownership of the technology been considered?

The project would focus on private ownership of small renewable power plants. This has shown to be effective even in countries where large power plants are operated by state-owned companies.

Secondary issues

Linkages to other focal areas

Efforts must be made to design projects that are consistent with the operational strategies of the other focal area and avoid negative impacts in focal areas outside of the focus of the project. One of the strategic considerations in the operational strategy is that where feasible and cost-effective, activities will be designed to contribute to global environmental benefits in other focal areas and in the cross-sectoral area of land degradation.

The type of project activity would have no significant adverse effect on other GEF focal areas or in land degradation. The only exception could be "International waters", and is discussed below.

Linkages to other programmes and action plans at the regional subregional levels

GEF activities are to be coordinated with past, ongoing and prospective work of the Implementing Agencies and other bodies. In addition, GEF activities should build upon bilateral and technical assistance and investment activities. Is there evidence that the GEF intervention will be undertaken building on other ongoing initiatives?

The proposed project is strongly linked to other activities, both past and prospective. In the first place, as a consequence of past initiatives to promote renewable energy in Armenia, there is already in place favorable tariffs and purchase guarantees, e.g. $0.045 /kWh for small hydropower and $0.07 /kWh for wind power, with purchase guarantees up to 2016. At these prices, many renewable projects in these categories can be viable. Moreover, the GEF project is accompanied by financing from several sources, namely IDA, EBRD, CFF, and other sources. These loans would complement the barrier removal to be provided by the GEF grant and make it possible to implement projects, while leaving infrastructure in place for future renewable power projects.

There are several mentions of the Clean Development Mechanism (CDM) within the Project Appraisal Document. Note, however, that projects that receive public funding are normally excluded from the CDM. CDM projects are usually project specific, so that there is no direct incompatibility between the GEF grant (directed at reducing barriers which are not project specific) and potential CDM projects. However, specific projects that receive loans from the IDA, EBRD, and GOA are likely to become excluded from consideration by the CDM. Moreover, the "additionality" of CDM projects need to be demonstrated through "investment analysis" or by showing that the project in question faces barriers. If the GEF project is successful in removing barriers, then potential projects are unlikely to qualify under the CDM on the basis of barrier analysis. CDM investment analysis requires showing that the proposed project activity is economically or financially not attractive compared to other alternatives, without revenues from the sale of carbon credits (CERs). Thus, potential CDM projects in renewable power generation are likely to be limited to such small hydropower and small wind power projects that are financially marginal.

Team response: *Since IDA and EBRD funds will be on-lent to sub-borrowers on non-concessional (market) terms, the sub-projects will qualify for the CDM. The contribution of CDM to project financial viability will be limited and was not taken into account in the financial analyses; it is expected to be only complementary and is not intended to be a major part of the Project and have a major impact on Project implementation. During the Project implementation each sub-project will be evaluated to determine whether it meets the CDM requirements, including additionality, eligibility (in case it receives ODA or government assistance), etc. While some sub-projects may not meet CDM requirements most of the sub-projects are expected to meet them. The PAD will be revised to make this more explicit.*

Other beneficial or damaging environmental effects

What will be the environmental impact of the project activities?

Positive or negative transfers to the focal area of biodiversity and international waters and also land degradation may occur as a result of energy projects.

The project proposes to promote the development of renewable power, especially small hydropower

and wind power. Wind power has perhaps the lowest environmental impact of any power generation technology. It has no transboundary effects. Large dams have been questioned on the basis of flooding of large areas, leading to the loss of biodiversity. The proposed project would only consider small hydropower, with a large number of run-of-river projects that involve little or no flooding, so that there would be an insignificant impact on biodiversity. Insofar as any hydropower project may be on a river that is a boundary with another country, e.g. Turkey, there will be many bilateral issues involved, including the question of "International Waters." "Projects on International Waterways" are mentioned in Section 6 of the Appraisal Summary: *Safeguard Policies*. If the projects to be considered for implementation include boundary rivers, this issue needs to be discussed.

Team response: *This issue will be addressed before appraisal in accordance with the World Bank safeguards policy on international water.*

Degree of involvement of stakeholders in the project

In OP5, the participants are industries and para-statal organizations. In projects dealing with energy efficiency in rural areas , public participation of affected beneficiaries is essential to the success of the project. In OP6, local participation is a by-ingredient in the design, implementation and operation of isolated systems. The forms and degree of participation will vary as some technologies may require communities to act in concerts, while other technologies require the participation of electric utility companies, industrial enterprises etc.

This project falls within GEF Operational Program #6: *Promoting the adoption of renewable energy by removing barriers and reducing implementation costs.*

Questions that could be raised:

1. Assess the degree of stakeholder involvement.

Potential stakeholders relevant for small power projects have been correctly identified, and the PAD states that most stakeholders were consulted in project preparation, and as a part of "identification of capacity building needs" in the associated PDF-B grant. The PAD also mentions a future stakeholder meeting to be held in July 2005. Nevertheless, the PAD does not provide any details by which this reviewer can determine the opinions expressed by the stakeholders, and whether/how these opinions were taken into consideration.

Team response: *The key stakeholders include existing and potential project developers, NGOs dealing with renewable energy, environmental and energy efficiency issues, the GOA, the PSRC, key co-financiers (EBRD, CFF), and local FIs. Extensive consultations, bi-lateral discussions have been carried out with these stakeholder groups to develop the Project design and scope. Specifically, the barriers impeding the development of renewables in Armenia as well as the measures needed to remove them (as addressed under the TA component of the Project) have been largely identified through stakeholder consultations. The feedback from the stakeholders so far has been positive due to the positive environmental impact that the Project is expected to have, the close alignment of Project objectives with the GOA's policy priorities in the energy sector and the overall attractiveness of the renewable projects for the private sector. The degree of stakeholder*

involvement will be elaborated in more detail in the PAD.

2. What is the degree of commitment of those involved in the project?

As commented in the previous item, the PAD and its annexes do not contain details of the stakeholder consultation process in order to determine the degree of commitment of those involved.

Team response: *The established legal and regulatory environment in the country (required off-take of electricity produced, fixed cost-recovery tariffs for small hydros and wind, full and timely payments from the distribution company, etc. as described in Annex 1) is supportive to the development of the renewable energy, and is a testament to the strong commitment of the GOA and the PSRC to the Project. Further, the GOA has highlighted the development of renewable energy resources as a priority area in the PRSP. EBRD, which is a key co-financier, has recently approved the Project Structure Review and is currently in the process of preparing for the due diligence and negotiations. The Cafesjian Family Foundation, an American Diaspora development organization, has also expressed an interest to participate in the Project and has sent a comfort letter indicating this. Finally, the series of consultations arranged during the Project preparation or organized by the USAID have indicated strong interest for the Project among private investors. Also, see comments above.*

3. Women's participation (in rural energy projects)?

The project involves supply-side activities involving power generation, where the electricity to be generated would be combined with electricity generated in other power plants before reaching end users. There appear to be no gender specific issues that might be present in demand-side measures, e.g. involving end-use energy efficiency in the household sector or in commerce and industry where end use activities may be gender specific.

4. Assess the degree of coordination and cooperation with the NGO and private sector (in rural energy projects).

While the activities are not specifically "rural energy projects" in the usual definition, since they involve the supply of energy, nevertheless, the role of NGO and private-sector stakeholders can be relevant, both in terms of local environmental impact as well as land ownership and siting issues. The PAD claims that the project concept would be presented to NGOs in a future workshop (July 2005).

The implementation arrangements (Annex 6) mentions that the project would be implemented by a Renewable Energy and Energy Efficiency Fund (R2E2 Fund) which would be governed by a Board of Trustees (BOT). Three of the nine members of the BOT will be representatives from the private and NGO sectors. This should provide adequate representation in principle.

Capacity building aspects

Often a strong technical assistance is necessary during the preparation and the implementation phases. One of the generic barriers to energy conservation and efficiency is lack of trained

personnel and technical and managerial expertise.

How will the project build capacity in the sector where the project will be implemented?

Project preparation was supported by a PDF-B. The PAD content reflects these prior efforts. Project activities include a great deal of capacity building not only for project implementation but in order to ensure sustainability of renewable power project development well beyond the end of the specific GEF grant and associated credits.

Innovativeness of the project

For example, the success of renewable rural electrification will highly depend on innovative financing.

This reviewer disagrees that successful project financing needs to be "innovative." Tried and tested financing schemes often work, and with increasing experience in the promotion of renewable power projects, including financing aspects, it is more likely that successful financing will involve replication, adjusted for local realities, of solutions found to be successful elsewhere. This project appears to reflect the know-how accumulated in other projects as well as knowledge of the specific national context.

Other observations (not necessarily minor)

Note that the table in Section D.1 (PAD, Appraisal Summary, p. 18) shows different purchase prices that are different for natural water flows ($0.045/kWh) and for artificial water flows ($0.022/kWh). Since electricity purchase prices are key to project cost effectiveness, these values need to be clarified, together with a reference to the law or regulation where the values are specified.

Team response: *Tariffs for newly constructed small run-of-the-river hydropower and wind plants are set at USc 4.5/kWh and USc 7.0/kWh levels, respectively. These tariffs are fixed till 2016 according to the PSRC resolutions No 20 and 21 respectively from February 9, 2004. Cost-based tariffs are set by the PSRC for hydros on artificial water flows with 20 percent before-tax ROA allowed in the tariff. The tariffs for these SHPPs vary between USc 1.5-3.5/kWh with average tariff of USc 2.2/kWh used for economic analysis purposes. In addition, the Energy Law requires that the distribution company purchase 100 percent of electricity generated by the licensed renewable energy plants.*

The same section (D.1. Appraisal Summary, p. 18) mentions "tariffs" for different types of power generation technologies. Normally "tariff" is used to denominate price paid by end users of electricity. Since electricity purchased comes from different types of power plants with different generation costs, as well as transmission and distribution value added and losses, tariffs *do not* depend on technology. Thus, the document should clarify if this refers to the cost of generation (which depends on investment and operating costs, and does depend on technology choice) or to the wholesale selling price of generated electricity. The selling price may be fixed by a guaranteed purchase price which can be technology specific (such as implied here for renewable electricity), be determined by market conditions (supply vs. demand) in which case it is not technology specific.

Team response: *The "tariffs" refer to the wholesale tariff (price paid for purchasing electricity from different generators by the distribution company) and this will be clarified in the PAD.*

The same section (D.1. Appraisal Summary, p. 18) gives the "tariff" of a new CCGT power plant to be $0.04 to 0.05 / kWh. If this refers to the cost of generation from a combined cycle power plant using natural gas, this value seems very high. Please specify assumptions on natural gas prices, especially for power plants.

Team response: *The key assumption underlying this estimate of generation costs of a new CCGT plant are: (i) investment cost of US$750/kW (this is the estimated cost of a 200MW CCGT being currently constructed in Armenia through the financing provided by the Japanese government); (ii) natural gas consumption of 150 gram/kWh; (iii) natural gas price of US$130/1000m3 at the border (prices of natural gas Russia charges for its export of natural gas to the European markets), (iv) ROA at 20 percent (this is consistent with the ROA allowed by the PSRC for different generators and reflects Armenian cost of capital). These assumptions are spelled out in Annex 9.*

The text somewhat below Figure 3 of Annex 1 states that:"Armenia receives natural gas from Russia at substantially subsidized prices (US$53 per m3) and if the geopolitical situation changes and subsidies are removed the resulting impact of gas price increase on the Armenian economy will be significant."

Note that there is a typographic error in the price: it might be US$ 53 per 1000 m3, i.e. US$ 0.053 per m3. If so, it is not that cheap! Moreover, it is not clear what is implied by subsidies: e.g. (a) does Russia (or Russian producers) supply natural gas at prices below what it/they charge(s) other countries? Or (b) does the government of Armenia subsidize prices? Or other? Annex 9 specifies the border price of natural gas to be $130/1000 m^3. This suggests that GOA is subsidizing natural gas to users. Please confirm.

Team response: *The current gas price of US$53 on the border is indeed for 1000m3 and this typo has been corrected. This price is significantly lower than the prices Russia charges for its exports of natural gas to the European markets (in the range of US$130-135 per 1,000 m3 last year; and US$150-180 per 1,000 m3 this year). Russia charges different prices for the supply of natural gas to different countries and these prices most often do not reflect economic costs. Russia charges one of the lowest prices for its export of natural gas to Armenia, despite the fact that Armenia is a remote and small consumer. Annex 9 provides a comparative analysis of the economic costs of different generation alternatives and therefore uses the international price for natural gas of $130 per 1000 m3. The "subsidy" in the PAD implies the difference between the price Russia charges to Armenia and the international price of natural gas (the price charged to European consumers). The GOA does not subsidize natural gas prices to the end-users, and the end-user tariff is determined by adding transmission and distribution margin to the border price of gas. The meaning of the "subsidy" will be clarified in the PAD.*

Team response: *The Armenian Public Services Regulatory Commission uses 10MW as a threshold for small hydropower generation. Hence, this project has adopted the same convention.*

PAD and annexes make reference to "small wind" or SWPP. "Small" is not defined in terms of

power ranges. Because of scale economics, large wind power plants are more suitable for grid-connected power generation. Indeed, Annex 1, Table 3 lists potential grid-connected wind farm projects. The capacities range from 20 MW to 150 MW, thus indicating that these are no way "small wind". There are no specific negative environmental impact of large wind compared to small wind. Thus, it is not clear why the project would limit itself to small wind power. And, as suggested by Annex 1, Table 3, no such limitation is implied. If the project is to include all types of wind power, the text needs to be modified in many places to reflect this. If the project does indeed propose to exclude large wind, then the reasons for such exclusion need to be specified, and the text changes especially in Table 3 and elsewhere in Annex 1. While one reason for excluding large wind might be that at large scale, wind is likely to be more competitive with non-renewable power generation, substantial barriers exist for a full market penetration of wind power in many countries. This is likely to be the case in Armenia, where there appears to be limited experience with wind power. This reviewer thus does not believe that wind power should be limited to "SWPP", whatever that means.

Team response: *The comment is acceptable and the PAD will be revised accordingly.*

Text following Table 3 of Annex 1 mentions solar resources. It is not clear what solar technologies are being considered, since hydropower and wind are indirect forms of solar energy, so that the radiation levels are not directly relevant.

Team response: *Reference to solar includes solar thermal for heating and electricity production, as well as photovoltaics. This will be made clear in the PAD.*

Minor point: Under "Barriers to the development of renewable energy" (Annex 1, p. 28 et seq.), the document correctly notes that typical project investment sizes for small renewable projects (estimated to average $800,000) are too small for international investors. However, later on it states that "renewable projects are too large for most Armenian Fis." One would have thought that the size of renewable projects could be in the range of national FIs. What exactly is the investment range available to these FIs?

Team response: *Except for two-three large commercial banks, the loan portfolio of most of the FIs is below US$20 million. Renewable projects in the range of US$800,000-1,000,000 are quite large for most of the FIs, since these FIs can absorb limited number of loans in the sector, and therefore the business development and learning curve for the business would not be worth for them. Further, the restrictions imposed by the Prudential Standards of the Central Bank of Armenia, particularly the limitations imposed for the risk exposure of one borrower restrict lending opportunities of the magnitude indicated above.*

Note: Annex 14 provides "Country at a glance" for Macedonia FYR, and not Armenia! Please replace with Armenia table.

Team response: *This has been incorporated in the PAD.*

MAP SECTION

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ARMENIA

- SELECTED CITIES AND TOWNS
- PROVINCE (MARZ) CAPITALS
- NATIONAL CAPITAL
- RIVERS
- MAIN ROADS
- RAILROADS
- PROVINCE (MARZ) BOUNDARIES
- INTERNATIONAL BOUNDARIES

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