

ASIAN DEVELOPMENT BANK

TAR: PRC 37300

TECHNICAL ASSISTANCE
(Cofinanced by the Government of Denmark)

TO

THE PEOPLE'S REPUBLIC OF CHINA

FOR

RENEWABLE ENERGY FOR POVERTY REDUCTION

December 2003

CURRENCY EQUIVALENTS

(as of 1 December 2003)

Currency Unit	–	yuan (CNY)
CNY1.00	=	\$0.1208
\$1.00	=	CNY8.2773

ABBREVIATIONS

EMU	–	environment management unit
EPB	–	environment protection bureau
FIRR	–	financial internal rate of return
GHG	–	greenhouse gas
NO _x	–	nitrogen oxides
PM	–	particulate matter
PRC	–	People's Republic of China
QNNR	–	Qilianshan National Natural Reserve
SO ₂	–	sulfur dioxide
SEPA	–	State Environmental Protection Administration
TA	–	technical assistance
WACC	–	weighted average cost of capital

NOTES

- (i) The fiscal year of the Government ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

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I. INTRODUCTION

1. During the Asian Development Bank (ADB) Gansu Clean Energy Project Loan Fact-Finding Mission in 2003, the Government of the People's Republic of China (PRC) requested ADB assistance to promote sustainable energy development in poor and rural areas of Zhangye, Gansu Province. ADB Country Strategy and Program of 2003 included the proposed technical assistance (TA). The ADB Fact-Finding Mission visited the PRC from 29 to 31 October 2003. Discussions were held with the Government on the TA goals, purpose, scope, implementation arrangements, cost estimates, financing arrangements, and terms of reference. The TA framework is in Appendix 1.¹

II. ISSUES

A. Energy Balance in the Project Area

2. The Zhangye grid has experienced power shortages since the mid-1980s due to lack of generation capacity and the long distance to other generation sources. Installed generating capacity is 94.5 megawatts (MW) against a peak demand of about 200 MW. Power generation in 2001 was 163 gigawatt hours (GWh) against a demand of 900 GWh. The deficit of 737 GWh was resolved through load shedding and importing power from the Hexi corridor grid. The power situation in Zhangye will worsen as demand increases until new capacity is added.² By 2010 the energy deficit will require importing 914 GWh.

3. Although electrification extends to 97% of the population, poor and rural customers receive sporadic service and are the first to experience service interruptions. Under current grid expansion plans and without new initiatives to deliver improved energy service, poor and rural consumers will continue to experience poor service. Due to limited local fossil fuel resources in Zhangye, hydropower and other renewable energy options are cost-competitive.

4. In Zhangye, energy services are viewed as a government responsibility, but limited financial resources constrain government-led project development to reduce frequent power outages. Entrepreneurial solutions to provide energy services to this "low-end" market segment have not been promoted effectively despite higher-than-normal tariffs. A business model for private sector power development is needed that maximizes local ownership of energy assets in poorly served areas.

5. Prior ADB TA³ in the project area analyzed least-cost options for power expansion using available technologies for plants as small as 90 MW. Least-cost analysis concluded that hydropower is the least-cost alternative for Zhangye. For further expansion of generating capacity, clean energy alternatives appear favorable, and new small hydropower plants and other clean energy projects are planned to improve service to poor and rural communities.

¹ The TA first appeared in *ADB Business Opportunities* (Internet edition) on 26 June 2003.

² The Xiaogushan hydropower component of the Gansu Clean Energy Development Project (footnote 6) will add 98 MW generating capacity to the Zhangye grid. The Longshou Phase II Project, under construction, will add 142 MW generating capacity by 2005. A conceptual plan envisions five more hydropower stations upstream of the Xiaogushan site, but no firm commitment exists to develop those sites. The 600 MW Pingliang coal-fired power plant is also scheduled for completion by 2007.

³ ADB. 2001. *Gansu Hydropower Project*. Manila.

6. ADB has provided TA⁴ to the PRC to evaluate energy development options and strategies to improve energy service delivery. Several barriers to clean energy and renewable energy development have been identified, including the following:

- (i) **Energy policy framework.** Clean energy options appear to be economically and financially attractive in many cases, but no formal government policy directly promotes such projects.
- (ii) **Lack of information about energy alternatives.** Hydropower and other forms of renewable energy are sometimes perceived to be too expensive or technologically unreliable. In local grids with large power deficits, demand-side management may be overlooked in favor of pursuing large generating plants.
- (iii) **Market incentives.** The energy service market is theoretically “open” with respect to generation, but new projects are subject to regulatory uncertainty due to ongoing restructuring in the power sector. No specific market incentives are in place to promote energy services in poor and rural areas.
- (iv) **Technology development and transfer.** The full spectrum of energy technologies is readily available in the PRC and Gansu, but entrepreneurial technology development firms generally focus on hardware sales rather than on project applications.
- (v) **Regulatory framework.** No uniform contract model or operating record exists for power purchase and sales agreements for distributed generation and industrial cogeneration.
- (vi) **Financing.** Large generation projects receive favorable treatment by state commercial banks because they are perceived to have low risk. Projects in poor and rural areas are not perceived as good business opportunities, and entrepreneurs working in these markets have difficulty obtaining commercial financing.

B. Clean Energy Alternatives

7. The poverty reduction benefits of improved energy services utilizing renewable energy and energy efficiency have been demonstrated in rural and remote areas where grid service is nonexistent or unreliable, and grid expansion would require unaffordable tariffs. In the proposed project area, many customers receive either unreliable electricity supply or no supply at all. Hydropower and other forms of renewable energy appear to be the most affordable option for providing energy and electric service. Improving the reliability of electric service will have direct and indirect economic benefits to poor and rural areas. Increased use of more efficient appliances with lower life-cycle costs (but higher purchase price) translates into direct financial benefits for users, and increased use of electrical appliances in agro-processing will improve processing efficiency, increasing value-added outputs. Reduced time for protracted livelihood chores will increase time available for alternative income-generation activities.

8. Clean energy alternatives appear to be affordable and cost-effective in the project area. Residential tariffs in rural service areas of Gansu range from CNY0.54 to CNY1.00 per kilowatt-hour (kWh). Small hydropower (less than 100 MW) is cost-effective at a wholesale tariff of

⁴ ADB. 2002. *Opportunities for Clean Development Mechanism in the Energy Sector*. Manila; ADB. 1998. *Technical Assistance Cluster for the Promotion of Clean Technology*. Manila.

CNY0.26 per kWh.⁵ The Zhangye and Hexi grid operating companies offer wholesale tariffs of CNY0.29 per kWh for hydropower and CNY0.35 per kWh for coal-fired power. Small-scale generation alternatives are estimated to cost from CNY0.58 per kWh for a 12 MW coal-fired plant, and CNY1.39 per kWh for diesel generator sets. Other renewable energy options cost about CNY1.00 per kWh. To plan delivery of energy services in support of social development programs in poor and rural areas of Zhangye, the Gansu provincial government requested a TA in association with the Gansu Clean Energy Development Project.⁶

III. TECHNICAL ASSISTANCE

A. Purpose and Output

9. Consistent with ADB energy, environment, and poverty reduction policies, the TA's development goal is to improve economic and social welfare of poor and rural areas by improving energy and electric service delivery in a sustainable manner. The TA objectives are to (i) assess least-cost options for supplying energy in underserved areas of Zhangye; (ii) assess willingness to pay for, and affordability of, energy in poor and rural areas; and (iii) develop a corresponding business plan that will optimize financial and economic benefits to poor and rural customers.

B. Methodology and Key Activities

10. The TA has the following key activities:

- (i) Develop least-cost expansion options for the Gansu power network to determine the need for new energy service investments to serve poor and rural customers.
- (ii) Review the regulatory framework and identify barriers to energy service development in poor and rural areas, and recommend ways to remove barriers to private sector participation, mobilize it, and maximize local ownership.
- (iii) Define technical, cost, and price parameters for construction and operation of energy systems on a financially sustainable basis in poor and rural areas, taking into account comparative advantages of energy-efficiency applications, small-scale hydropower, solar, wind, or other renewable resources.
- (iv) Evaluate in detail at least two project proposals (from a long-list of up to 10 candidate projects) based on local demand, expected tariffs, investment requirements, financial return, and economic viability following ADB's *Guidelines for the Economic Analysis of Projects*.
- (v) Identify institutional and human resource requirements for a self-sustaining energy service organization that designs, builds, and operates energy service systems in poor and rural areas.
- (vi) Prepare a business plan to establish a commercial energy service provider, including (a) legal requirements for different corporate structures (e.g., independent power producer, energy service company, cooperative, not-for-profit company); (b) staffing, recruiting, and internal training; (c) market development;

⁵ These estimates were developed for the Gansu Clean Energy Development Project (footnote 6).

⁶ ADB. 2003. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the People's Republic of China for the Gansu Clean Energy Development Project*. Manila.

and (d) financial plan including capital investment plan; financing plan; and financial projections (income statement, balance sheet, and cash flow), considering tariff options and financial implications of the corporate structure options.

- (vii) Define indicators and mechanisms to monitor and quantify poverty reduction benefits of the candidate investment projects.

11. The expected results and deliverables are the following:

- (i) an assessment of renewable energy and energy efficiency potential in designated poverty areas of the province;
- (ii) definition of enabling requirements for commercial renewable energy and energy efficiency investments using different corporate/organizational approaches;
- (iii) region-specific proposals for new renewable energy and energy efficiency projects and services;
- (iv) at least two project proposals developed for commercial investment, and other potential projects identified;
- (v) an assessment of poverty reduction potential due to improved energy services using renewable energy and energy efficiency; and
- (vi) dissemination and discussion of study findings in a provincial (or national) seminar and via the Internet.

12. Candidate project selection will emphasize “ground-up” renewable energy commercialization with local community development and ownership. The potential for financial support through sale of emission reduction credits will be explored. The TA will provide a business plan to create commercial energy service organizations, using external funding as appropriate and necessary. Provision of the TA does not necessarily commit ADB to finance any ensuing projects.

C. Cost and Financing

13. The total cost of the TA is estimated at \$750,000 equivalent, comprising \$420,000 in foreign exchange, and \$330,000 equivalent in local currency costs. The TA will finance the entire foreign exchange cost and \$180,000 equivalent in local currency cost on a grant basis, with \$450,000 from the Danish Cooperation Fund for Renewable Energy and Energy Efficiency in Rural Areas, and \$150,000 from ADB’s TA funding program. The Government will finance the remaining \$150,000 equivalent in local currency cost. Detailed cost estimates are in Appendix 2.

D. Implementation Arrangements

14. An international consulting firm or institute in association with a domestic consultant will be engaged using the simplified technical proposal procedures in accordance with ADB’s *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB for engaging domestic consultants. The quality- and cost-based selection procedure will be employed for recruitment. Indicative terms of reference for the consulting services are in Appendix 3.

The consultants will procure equipment for pilot projects in accordance with ADB's *Guidelines for Procurement*. Equipment will be delivered to the Government at the conclusion of the TA.

15. The TA will be carried out over 12 months, from May 2004 to May 2005, with total input of international and domestic consultants of about 13 and 20 person-months, respectively. The TA will be implemented in two phases. Phase 1 will comprise review and analysis of power network development plans, review of the regulatory framework and potential for private sector participation, determination of the need for new energy service provision to poor and rural customers, stakeholder consultations, and selection of projects for detailed evaluation. Phase 2 will comprise detailed project evaluation. Procurement of hardware to operate village- and household-scale pilot projects will be considered in consultation with the Government and local stakeholders.

16. Project reports will include (i) an inception report submitted within 1 month of mobilization, summarizing results of initial review, evaluation, stakeholder consultations, and a list of up to 10 candidate projects; (ii) an interim report to be submitted within 3 months of mobilization, including recommendations for detailed project analysis; (iii) a draft final report, to be submitted within 11 months of mobilization; and (iv) a final report, to be submitted 12 months after mobilization. Monthly progress reports will be submitted to ADB using a standard two-page TA report format.

17. The Gansu provincial government will be the Executing Agency for the TA, and the Zhangye City government will be the Implementing Agency. The Gansu provincial government, in consultation with ADB, will assign a project leader and counterpart staff to work on the project; and identify and establish a TA steering committee, with representatives from relevant government agencies, nongovernment organizations, and other stakeholders. The steering committee will be chaired by the Gansu provincial government. Local participation will be assured by appointing local government representatives.

IV. THE PRESIDENT'S DECISION

18. The President, acting under the authority delegated by the Board, has approved (i) ADB administering a portion of technical assistance not exceeding the equivalent of \$450,000 to be financed on a grant basis by the Danish Cooperation Fund for Renewable Energy and Energy Efficiency in Rural Areas, and (ii) ADB providing the balance not exceeding the equivalent of \$150,000 on a grant basis, to the Government of the People's Republic of China for Renewable Energy for Poverty Reduction, and hereby reports this action to the Board.

TECHNICAL ASSISTANCE FRAMEWORK

Design Summary	Performance Targets	Monitoring Mechanisms	Assumptions and Risks
<p>A. Sector Goal Advance government plans for sustainable development by expanding the use of energy efficiency and renewable energy (RE) in small towns, villages, and poor rural areas of Gansu Province</p>	<p>5–8% increase of clean energy supplied in project areas in line with national goals</p> <p>Increase in income generation due to improved energy services</p>	<p>Provincial and local statistical surveys and annual reports</p>	<p>The Government is committed to promoting an enabling policy</p>
<p>B. Purpose Examine potential for new energy service initiatives in small towns, villages, and rural areas</p> <p>Develop candidate energy projects suitable for commercial investment in poor and rural areas</p>	<p>Assessment of energy efficiency/RE potential in rural Gansu; based on local resources and conditions, design of projects to improve energy services in underserved areas</p> <p>Development of energy service projects that can be replicated in other areas</p>	<p>Reports on energy data and trends, environmental and poverty assessments, and other consultants' reports</p> <p>Lists of identified possible projects</p> <p>Actual project design for implementation</p> <p>Implementation of two pilot projects to demonstrate commercial-scale RE initiatives</p> <p>Review missions</p>	<p>Data is available and capable consultants are recruited</p> <p>Local government and relevant agencies cooperate and provide the necessary information</p> <p>Counterpart support for project selection and design is timely</p> <p>Pilot projects can be actively managed with support of project stakeholders</p>
<p>C. Outputs Assessment of RE potential in poor rural areas of the province</p> <p>Definition of enabling requirements for commercial RE investments using different organizational approaches</p> <p>Region-specific proposals for new RE and energy efficiency projects and services</p> <p>At least two pilot projects developed for commercial investment, with other potential projects identified</p> <p>An assessment of poverty reduction potential due to RE development</p> <p>Dissemination and discussion of study findings in a provincial (or national) seminar and through internet</p>	<p>Review of existing policies for promotion of RE and energy efficiency</p> <p>Development of a provincial-level investment program for RE</p> <p>Draft policies promoting the development and improvement of RE programs</p> <p>Identification of at least 8–10 pilot project proposals</p> <p>Development of 2 RE project schemes on pilot basis</p>	<p>Institutional policies promoting the use of RE and energy saving</p> <p>Provincial RE policies and program</p> <p>Policy dialogue, review mission, progress report, and consultants' reports</p> <p>Pilot project design</p> <p>Programs for the most attractive RE projects identified</p>	<p>Government remains committed to promoting RE and energy efficiency programs</p> <p>Local government agencies cooperate and provide information necessary</p>

Design Summary	Performance Targets	Monitoring Mechanisms	Assumptions and Risks
<p>D. Activities</p> <p>Review least-cost expansion plans for power system expansion and confirm the need for new energy services for poor and rural customers</p> <p>Identify barriers to energy efficiency and RE development and recommend steps to remove these barriers</p> <p>Define technical and financial parameters for construction and operation of energy efficiency and RE systems on a financially sustainable basis in poor and rural areas</p> <p>Develop at least two pilot energy efficiency and RE service projects</p> <p>Identify the institutional and human resource requirements for self-sustaining RE project in poor rural areas</p> <p>Prepare a business plan to establish a commercial energy services provider</p> <p>Define appropriate indicators and mechanisms to monitor and quantify poverty reduction benefits of the pilot projects and similar future projects</p>	<p>A comprehensive assessment of energy service needs, considering least-cost expansion plans; barriers to energy service development; and technical, financial, economic, and social aspects of potential energy service projects</p> <p>Action plan incorporating energy efficiency and RE objectives and programs</p> <p>Recommendation of new policies to promote RE</p> <p>Presentation of technical assistance findings to agencies concerned and stakeholders</p>	<p>List of potential RE projects</p> <p>Action plan and financial and technical analysis of the pilot projects</p> <p>Progress reports and final report</p> <p>RE development web site</p> <p>Dissemination of publications</p>	<p>Data and information are available</p> <p>Consultants are capable of performing the required tasks</p> <p>Local government agencies cooperate and provide the necessary information</p> <p>Local government agencies and stakeholders are involved in selecting and implementing pilot projects</p> <p>National and provincial laws are complied with</p>
<p>E. Inputs</p> <p>1. Consulting services</p> <p>2. Total cost</p> <p>3. Financing</p>	<p>International consulting services for 13 person-months</p> <p>Domestic consulting services for 20 person-months</p> <p>Estimated total cost of the TA of \$750,000</p> <p>The Asian Development Bank will finance \$150,000 equivalent from technical assistance special fund and \$450,000 equivalent from the Government of Denmark</p>	<p>Consultants' contracts</p>	<p>The Government is committed to provide counterpart support and facilities</p> <p>Consultants are engaged and fielded on time</p>

RE = renewable energy

COST ESTIMATES AND FINANCING PLAN
(\$)

Item	Foreign Exchange	Local Currency	Total Cost
A. Asian Development Bank^a			
1. Consultants			
a. Remuneration and Per Diem			
i. International Consultants (3 person-months)	75,000	0	75,000
ii. Domestic Consultants (5 person-months)	0	25,000	25,000
b. International and Local Travel			
i. International	10,000	0	10,000
ii. Domestic	0	5,000	5,000
c. Reports and Communications	2,500	2,500	5,000
2. Equipment and software	5,000	5,000	10,000
3. Training, Seminars, Conferences	0	0	0
4. Representative for Contract Negotiations	5,000	0	5,000
5. Contingencies	10,000	5,000	15,000
Subtotal (A)	107,500	42,500	150,000
B. Danish Cooperation Fund for Renewable Energy and Energy Efficiency in Rural Areas^b			
1. Consultants			
a. Remuneration and Per Diem			
i. International Consultants (10 person-months)	250,000	0	250,000
ii. Domestic Consultants (15 person-months)	0	75,000	75,000
b. International and Local Travel			
i. International	10,000	0	10,000
ii. Domestic	0	10,000	10,000
c. Reports and Communications	2,500	2,500	5,000
2. Equipment and Software for Possible Pilot Projects	20,000	20,000	40,000
3. Training, Seminars, Conferences (including stakeholder consultations and expenses for international experts)	5,000	10,000	15,000
4. Contingencies	25,000	20,000	45,000
Subtotal (B)	312,500	137,500	450,000
C. Government Financing			
1. Office Accommodation	0	30,000	30,000
2. Remuneration and Per Diem of Counterpart Staff	0	60,000	60,000
3. Local Travel and Transport	0	15,000	15,000
4. Secretarial Support and Office Services	0	20,000	20,000
5. Office Equipment	0	13,000	13,000
6. Miscellaneous	0	12,000	12,000
Subtotal (C)	0	150,000	150,000
Total	420,000	330,000	750,000

^a Financed by the Asian Development Bank (ADB) technical assistance funding program.

^b Financed by the Government of Denmark.

Source: ADB estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The consulting team (international and domestic experts) will have the following expertise: (i) renewable energy and energy efficiency project development, (ii) environmental analysis, (iii) financial analysis, (iv) economic analysis, and (v) social development. The team of international consultants will coordinate work with domestic consultants. The international renewable energy and energy efficiency specialist will be the team leader for the technical assistance (TA). The team leader will allocate tasks among other consultants to maximize their contribution to the TA, depending on their experience. The team leader will be responsible for all coordination activities.

A. Renewable Energy and Energy Efficiency Specialist (5 person-months)

2. In addition to team leader activities, the renewable energy and energy efficiency specialist will be responsible for, but not limited to, the following tasks:

- (i) Review previous renewable energy studies, ongoing studies and recent TA reports,¹ the government energy policy, regulatory framework, and plans for energy sector development in the project area. An indicative list of potential energy investment projects is presented in Table A3.

Table A3: Examples of Proposed Renewable Energy Projects in Gansu Province
(CNY million)

No.	Proposed Projects	Total Investment	Proposed External Financing	Domestic Financing
1.	Green Energy Engineering (biomass gasification) Project in Jiuquan Region	120	60	60
2.	Hanwang Hydropower Station in Wudu County	104	60	44
3.	Geothermal Energy Resource Development in Tongwei County	160	60	100
4.	Dingjiaxia Hydropower Station in Hexipu EDZ of Yongchang County	37	18	19
5.	Tianwanggou Hydropower Station on Datonghe River	198	99	99
6.	Bingqiaowan Hydropower Station on Taohe River	133	66	67
7.	Jinkouba Hydropower Station on Baishuihe River	241	120	121
8.	Baiyiba Hydropower Station on Baishuihe River	157	78	79
	Total	1,150	561	589

Source: ADB-funded TA (footnote 1).

- (ii) Evaluate constraints on private sector participation and recommend changes in the regulatory framework to encourage and mobilize private sector provision of energy services in poor and rural areas.

¹ In particular, ADB. 2002. *Opportunities for Clean Development Mechanism in the Energy Sector*. Manila; and ADB. 2003. *Technical Assistance Cluster for the Promotion of Clean Technology Status of Implementation, Subproject 6*. Manila.

- (iii) Visit small towns and villages in the project area and prepare an inventory of energy efficiency and renewable energy activities and identify potential new energy service alternatives that can be developed. With other team members, identify a package of renewable energy projects for detailed analysis, and determine their suitability for meeting the population's needs.
- (iv) Identify the institutional and human resource requirements for a self-sustaining energy service organization that designs, builds, and operates energy efficiency and renewable energy systems.
- (v) Prepare a business plan to establish a locally owned commercial energy service provider, including (a) legal requirements for different corporate structures (e.g., independent power producer, energy service company, cooperative, not-for-profit company); (b) staffing, recruiting, and internal training; (c) market development; and (d) initial capitalization and ongoing financial management.
- (vi) Identify potential investments in energy efficiency and renewable energy projects, taking into account technical, social, environmental, financial, and economic factors; potential use of existing government subsidy; and possible packaging with inexpensive external finance under government guarantee.
- (vii) After consultation with the government and other local stakeholders, prepare two pilot projects that are suitable for commercial investment.
- (viii) Present project pilot designs at a stakeholder workshop involving government, local community representatives, and potential renewable energy investors.

B. Financial Analyst (3 person-months)

3. Using ADB's *Guidelines on Financial Governance and Management of Investment Projects*, the financial analyst will conduct a detailed financial assessment for the identified projects, including the following:

- (i) Prepare cost estimates and a financing plan for energy efficiency and renewable energy projects, including physical and price contingencies.
- (ii) In coordination with the team leader, prepare the financial plan for an energy service provider, including financial projections, income statement, balance sheet, and projected cash flow statement, including assumptions on key revenue and expenditure items.
- (iii) Prepare cost estimates, funding plans, and financial projections in domestic currency, and take into account the likely effect of inflation and potential for exchange rate fluctuations.²

² The project cost estimates and financial projections in nominal terms should be converted to real terms by removing the projected effects of foreign and domestic inflation and currency fluctuations. Incremental costs and benefits should form the basis of the financial evaluation.

- (iv) For candidate investment projects, compute the financial internal rate of return (FIRR) and weighted average cost of capital (WACC) FIRR and WACC should be computed after tax in real terms using constant 2004 prices.
- (v) Analyze the financial feasibility, including tariff and leasing options (with specific examples), for energy service initiatives in poor and rural areas.
- (vi) Help develop assessment criteria for the identified energy initiatives.
- (vii) Assess the financial performance of existing renewable energy initiatives.

C. Economist (2 person-months)

4. The economist will be responsible for, but not limited to, the following tasks:
- (i) Review the existing least-cost expansion plans for the Gansu power network and analyze options for new energy services for rural and poor customers.
 - (ii) Review the regulatory framework and identify barriers to energy service development in poor and rural areas, and recommend steps to remove barriers and mobilize private sector participation.
 - (iii) Review the economic impacts of existing and proposed energy service initiatives.
 - (iv) Assess the economic performance of existing energy service initiatives.
 - (v) Confirm demand for potential output and cost-effectiveness of proposed energy service projects.
 - (vi) Conduct economic assessment using ADB's *Guidelines for Economic Analysis of Projects* for the identified possible projects; calculate the economic internal rate of return and confirm that it is greater than the FIRR, and that the FIRR is greater than the WACC.

D. Social Development Specialist (3 person-months)

5. The social development specialist will be responsible for, but not limited to, the following tasks:
- (i) Review the social and poverty reduction impacts of proposed projects, including the financial implications of proposed projects for all stakeholder groups.
 - (ii) Perform detailed social assessment for the identified pilot projects.
 - (iii) Undertake beneficiary and stakeholder analysis, considering gender aspects.
 - (iv) Quantify target groups for sample projects and identify the benefits accruing to the target groups related to poverty reduction.
 - (v) Assess willingness to pay and affordability in candidate project areas.

- (vi) Assess opportunity for community participation in project construction, ownership, and operation.

E. Domestic Consultants (20 person-months)

6. Domestic consultants will be recruited to assist the international consulting team. They should have extensive local knowledge and an ongoing relationship with the People's Republic of China and Gansu energy industries. Domestic consultants will help international consultants to quickly familiarize with their tasks by translating various documents into English; researching and compiling a set of government policies, regulations, and procedures adopted; and ensuring that the work by international consultants is appropriate to local conditions. Domestic consultants will include a renewable energy and energy efficiency expert, financial/economic expert, environmental specialist, and social development specialist. In consultation with the international consultants and the EA, a domestic consultant will be appointed TA deputy team leader, and be responsible for day-to-day TA activity in the absence of the team leader.

7. The domestic consultants will have primary responsibility for obtaining detailed information on energy policy, technologies, and energy service providers to identify candidate pilot projects. The consultants will assist in financial and economic analysis of the pilot projects, and assess the social and environmental impacts of the proposed energy development program and candidate pilot projects, including but not limited to the following:

- (i) Review and assess the current and projected energy situation in the country and the overall impact on the environment.
- (ii) Identify the main environmental concerns in possible project areas and assess the potential environmental impacts of the identified possible energy projects. Quantify environmental and social impacts to the extent possible.
- (iii) Recommend cost-effective treatment, mitigation, and monitoring of potential environmental impacts from the identified projects.
- (iv) Develop selection criteria that will avoid negative impacts, enhance environmental improvement in new projects, and provide specific recommendations for project design.
- (v) Outline a comprehensive environmental management plan specific to the identified renewable energy projects, identifying resource requirements.
- (vi) Analyze energy consumption patterns in Gansu and estimate the potential for energy saving through development of renewable energy, with focus on greenhouse gas (GHG) emissions.
- (vii) Identify the extent of GHG emissions in possible project areas.
- (viii) Assess the effectiveness of candidate pilot project designs under consideration, to reduce the impact of GHG emissions.