



# Technical Assistance Report

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Project Number: 39652  
April 2006

## People's Republic of China: Preparing the Gansu Heihe Hydropower Development Project

## CURRENCY EQUIVALENTS

(as of 20 April 2006)

Currency Unit	–	yuan (CNY)
CNY1.00	=	\$0.01248
\$1.00	=	CNY8.0135

In this report, a rate of \$1.00 = CNY8.0135 is used.

## ABBREVIATIONS

ADB	–	Asian Development Bank
CDM	–	clean development mechanism
CO <sub>2</sub>	–	carbon dioxide
EA	–	Executing Agency
GDP	–	gross domestic product
GHG	–	greenhouse gas
HPP	–	hydropower plant
IA	–	implementing agency
MFF	–	multitranches financing facility
MW	–	Megawatt
NO <sub>x</sub>	–	nitrogen oxide
PRC	–	People's Republic of China
SO <sub>2</sub>	–	sulfur dioxide
TA	–	technical assistance
WTP	–	willingness-to-pay

## TECHNICAL ASSISTANCE CLASSIFICATION

<b>Targeting Classification</b>	–	General intervention
<b>Sector</b>	–	Energy
<b>Subsector</b>	–	Renewable energy generation
<b>Themes</b>	–	Sustainable economic growth, environmental sustainability
<b>Subthemes</b>	–	Fostering physical infrastructure development; cleaner production, control of industrial pollution.

## NOTE

In this report, "\$" refers to US dollars.

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## I. INTRODUCTION

1. During the 2005 country program midterm review, the Government of the People's Republic of China (PRC) requested Asian Development Bank (ADB) assistance for the Gansu Heihe Hydropower Development Project (the Project). The Project includes the construction of two medium-sized, run-of-river hydropower plants (HPP) on Heihe River in Gansu province: a 50.5-megawatt (MW) plant in Erlongshan, and a 60 MW plant in Dagushan. A project preparatory technical assistance (TA)<sup>1</sup> is included in the 2006 country program. The concept paper for the Project and the TA was approved in February 2006. The Fact-Finding Mission (the Mission) visited the PRC from 11 to 17 March 2006. The Mission discussed and agreed with the Government on the impacts, purpose, scope, implementation arrangement, cost estimates, financing arrangements, and terms of reference for consulting services. Given the (i) scope, (ii) discrete and sequential financing needs,<sup>2</sup> and (iii) staggered disbursement, the Government and the Mission agreed to use the requested Multitranche Financing Facility (MFF) approach to finance the Project and a phased TA implementation. The TA design and monitoring framework is in Appendix 1.

## II. ISSUES

2. The PRC has achieved and sustained an impressive economic growth, averaging about 9% a year for the past two decades. Compared with its 2000 level, the economy is expected to double by 2010 and quadruple by 2020. Given the projected growth trajectory and the relatively low<sup>3</sup> per capita energy consumption of about 0.66 tons of oil equivalent per year, the demand for energy is expected to continue to increase rapidly. Electricity demand is growing in step with the economy. After the United States, the PRC has the second largest power industry in the world. Installed generation capacity and power generation increased at an annual average of more than 8% over the past two decades. By the end of 2005, installed capacity reached 508 gigawatts and electricity generation totaled 2,470 terawatt-hours, an increase of 13% over 2004. To meet the projected demand, installed capacity will have to increase by 240% from the 2005 level to about 1,200 gigawatts in 2020. One of the key challenges to sustaining economic growth is to improve significantly the energy intensity.<sup>4</sup> The Government's highest sector priorities are energy conservation and improved energy efficiency.

3. Despite the impressive growth and achievements, the power sector faces many challenges, particularly:

- (i) **Increasing dependence on coal.** The share of coal-fired power plants has been increasing, while the hydropower contribution has been shrinking from about 30% of installed capacity in 1990 to 26% in 2004. Hydropower's share of installed capacity is likely to decline to 24% by 2010. Coal-fired power plants contributed about 81% of electricity generation in 2005, compared with 15% from HPPs. Rising coal consumption has created environmental problems.
- (ii) **Power shortages.** Since 2001, the PRC has faced power shortages. Accelerated capacity addition is likely to overcome this problem by 2007.

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<sup>1</sup> The TA first appeared in *ADB Business Opportunities* on 9 December 2005.

<sup>2</sup> Erlongshan subproject is scheduled for completion in 2007; Dagushan in 2009.

<sup>3</sup> About one tenth that of the United States per capita energy consumption.

<sup>4</sup> Energy intensity is the amount of primary energy consumption per unit of gross domestic product (GDP). In the PRC, energy intensity is about 20–100% more than OECD countries for many industrial processes. Source: World Bank. 2006. China Quick Facts.

Available: <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/CHINAEXTN/0>

However, the greater challenge remains—generating the power needed to quadruple the economy by 2020.

- (iii) **Unbalanced power structure.** More than 80% of the generation capacity is in the eastern and central regions. Inadequate local generation capacity and weak interregional grid connections have led to suboptimal utilization of power resources.

4. About 60% of the cities do not have acceptable air quality, and six of the world's most polluted cities are in the PRC. The rapid increase in coal consumption is one of the major causes of poor air quality.<sup>5</sup> Coal-fired power plant emissions<sup>6</sup> comprise suspended particulates, sulfur dioxide (SO<sub>2</sub>), nitrogen oxide (NO<sub>x</sub>), and carbon dioxide (CO<sub>2</sub>). The increase in coal-fired power plants will lead to more greenhouse gas emissions (CO<sub>2</sub>). Acid rain, caused primarily by SO<sub>2</sub> and NO<sub>x</sub> emissions, falls on one third of the country. Environmental pollution is a huge burden on the economy.<sup>7</sup> Recognizing the energy-environment nexus, the Government enacted the Renewable Energy Law to promote cleaner energy and electricity production which came into effect on 1 January 2006. Further regulations for administration and tariffs have also been issued. Accelerated development of small- and medium-sized HPPs is a key element of the plan to promote cleaner energy production.

5. Like many other provinces, Gansu province has experienced rapid economic growth and associated power shortages. The Gansu electricity network is part of the Northwest power grid, and is a net power importer from neighboring provinces. Some areas, such as the Hexi corridor, have had chronic power shortages due to inadequate local generation capacity and the long distance from power plants. Coal-fired thermal power plants are the main sources of electricity in Gansu province, while hydropower contributed 35% in 2004. Most of the cities in the province do not have an acceptable ambient air quality (grade II national standard). The capital, Lanzhou, had the fourth worst air pollution index of 47 key national environmental cities in 2004. A combination of coal combustion and desertification causes the poor air quality. The development of clean and renewable energy sources is one of the priorities of the provincial government to reduce air pollution.

6. Zhangye City<sup>8</sup> is a poor area in the province with deficient electricity supply and bad air quality. Almost 80% of the 1.3 million people living in Zhangye City are classified as rural. Of its rural population, about 23% have income less than the provincial rural poverty line. Zhangye City power network is part of the Hexi corridor network, which in turn is part of the Gansu and Northwest power networks. Due to inadequate peaking capacity in the network, Zhangye City has frequent power interruptions. Insufficient power generation capacity results in acute peak power shortages and poor quality of the power supply (low voltage and occasional blackouts). Power outages are common in rural areas.<sup>9</sup> Poor quality and unreliable electricity supply inhibit industrial and commercial activities, and constrain economic growth and job creation in rural areas. The unreliable supply also promotes switching to more polluting fuels. Air quality, in terms of suspended particulates, was grade III.

<sup>5</sup> The PRC is the world's largest coal producer and consumer. In 2004, it produced about 2 billion tons of coal.

<sup>6</sup> Emissions can be significantly reduced through (i) improved coal technologies, (ii) substitution of low sulfur coal, and (iii) flue gas desulfurization.

<sup>7</sup> A World Bank estimate suggests \$54 billion per year in environmental pollution and associated health problems in the PRC.

<sup>8</sup> Zhangye City is an administrative unit under the provincial government, it includes five counties with mainly rural areas.

<sup>9</sup> Rural areas generally are connected at the far end of the distribution network. During supply-demand imbalances, they are switched off first.

7. The Heihe River is the second largest inland river in the PRC and the largest in the Hexi corridor. Traversing more than 800 kilometers, the river passes through Qinghai province, Gansu province, and Inner Mongolia Autonomous Region. The section from the Huangzhang Temple to the Yingluo gorge in Zhangye City is an excellent source of hydropower generation. The Heihe River Development Plan has identified eight potential cascade sites—seven of which are in Zhangye City—with total hydropower potential of about 800 MW. Within the 11<sup>th</sup> Five-Year Plan, the Government identified the accelerated development of the Heihe River cascade scheme as a key local initiative to alleviate chronic power shortages in an environment-friendly manner, and to spur economic development of rural areas within Zhangye City. Of the cascade's seven schemes, two are in operation, while two are under construction<sup>10</sup> and scheduled for completion in 2007. To achieve its target, the Government is seeking ADB assistance for the accelerated development of the next two run-of-river hydropower schemes in Erlongshan and Dagushan.

8. The Heihe River cascade scheme will provide a source of clean and renewable energy closer to the power-deficient rural communities of Zhangye City. A least-cost generation planning study was carried out in 2003 for Gansu province under an ADB-financed loan (footnote 10). This study identified medium-sized HPPs as the least-cost generation option. These schemes will replace the coal-fired power plants, thereby reducing harmful emissions. The Xiaogushan hydropower scheme, financed under another ADB loan, is an example of this successful transition. This project has contracted carbon emission reductions under the clean development mechanism (CDM) to the Prototype Carbon Fund of the World Bank.<sup>11</sup>

9. The development of renewable and clean energy sources to provide direct benefits to the rural poor is a priority of ADB's energy policy. Further, the acceleration of rural development by strengthening rural infrastructure and services is a strategic focus of ADB's program for the PRC. The strategy, designed to support the 11<sup>th</sup> Five-Year Plan, aims for balanced regional development through physical and social infrastructure improvement. In the energy sector, the strategy focuses on supporting energy conservation and mitigating adverse environmental impacts of capacity expansion.

10. ADB has been helping Gansu province develop a complete array of renewable energy sources. Erlongshan hydropower subproject feasibility was approved by the provincial authorities in October 2005. The proposed Dagushan hydropower subproject pre-feasibility was carried out with a continuing ADB advisory TA.<sup>12</sup> Under this TA, a pilot stalk gasifier to provide cooking gas to rural households, and to generate electricity, was implemented successfully. In addition, Gansu was one of the target provinces that identified clean energy projects under a cluster TA.<sup>13</sup> The proposed project will be designed to complement the continuing interventions in the energy sector, and to maximize the impact on the rural economy.

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<sup>10</sup> 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 Project*. Manila (Loan 2032-PRC). The 98 megawatt Xiaogushan hydropower scheme is being developed under this loan.

<sup>11</sup> This was the first hydropower plant in PRC approved by the Government for selling carbon emission reductions under the CDM.

<sup>12</sup> ADB. 2003. *Technical Assistance to the People's Republic of China for the Renewable Energy for Poverty Reduction*. Manila (TA 4309-PRC, approved on 19 December 2003, for \$600,000).

<sup>13</sup> ADB. 1998. *Technical Assistance to the People's Republic of China for the Promotion of Clean Technology*. Manila (TA 3079-PRC, approved on 29 September 1998, for \$3,500,000).

### **III. THE TECHNICAL ASSISTANCE**

#### **A. Impact and Outcome**

11. The project impact will be a reliable and environmentally clean energy supply supporting economic growth in the rural areas of Gansu province. The TA outcome will be to produce an agreed project design, feasibility study, and implementation arrangements suitable for ADB financing.

#### **B. Methodology and Key Activities**

12. The TA scope will include the phased preparation of the Erlongshan and Dagushan hydropower subprojects, starting with the Erlongshan subproject. The consultant will (i) review and update the relevant studies, analyses, and data on subproject feasibility reports; (ii) review demand forecasts, and undertake a least-cost analysis for additional generation capacity in the Hexi corridor network and Gansu province; (iii) prepare project loan proposals for consideration by the Government and ADB, including the necessary documents under the safeguard policy; and (iv) identify the potential for carbon emission reductions under CDM and other incentives available under the Global Environment Fund.

13. The major assumptions and risks that need to be considered for successful TA implementation include (i) change in Government priorities, (ii) lack of adequate and timely provision of data, (iii) delay in submission of required studies, (iv) delay in consultant selection, and (v) poor consultant performance. The Gansu provincial government has agreed to provide adequate counterpart support and data when needed. Close coordination among the consultants, executing and implementing agencies, and ADB will mitigate these risks.

#### **C. Cost and Financing**

14. The TA will cost \$650,000 equivalent. ADB will finance \$500,000 equivalent on a grant basis by ADB's TA funding program. The Government will finance the remaining \$150,000 through in-kind contributions, including office accommodation and facilities, counterpart staff, and data and other information needed for the TA. The cost estimates and financing plan are in Appendix 2. The Government has been informed that approval of the TA does not commit ADB to finance any ensuing project.

#### **D. Implementation Arrangements**

15. The Gansu provincial government will be the Executing Agency. Zhangye City government, through the Heihe Hydropower Company, will be the Implementing Agency. The Zhangye City government will provide a TA project director for day-to-day management of TA implementation. A steering committee or a lead group will be established and begin functioning within 2 weeks of commencement of TA activities to oversee and guide the TA implementation. The committee will comprise representatives of relevant departments and agencies of the Zhangye City government.

16. The TA scope will include both subprojects. However, to match with the subprojects' implementation schedule, the TA will have two parts that will be implemented over 10 months. The first part of the TA will focus on preparation of the Erlongshan subproject, which is expected to start in May 2006 and be completed by August 2006. For this part, international consultants will provide 4 person-months of services, while domestic consultants will provide

10 person-months. The second part of the TA, which will review feasibility studies and prepare the Dagushan subproject for ADB financing, will begin in July 2006 and be completed by February 2007. International consultants will provide 6 person-months of services for this part of the TA, while domestic consultants will provide 16 person-months. The consultants will procure the office equipment, which they will deliver to the Implementing Agency at the conclusion of the TA.

17. ADB will engage the international and domestic consultants in accordance with the *Guidelines on the Use of Consultants by Asian Development Bank and its Borrowers* and other arrangements satisfactory to ADB for the recruitment of domestic consultants. ADB will recruit individual consultants directly to fast-track their mobilization during the first part of the TA. The following international consultants will be required for the first part: (i) hydropower expert (1 person-month), (ii) social and/or poverty specialist (1.5 person-months), and (iii) economist (1.5 person-months). Domestic consultants will include (i) hydropower expert (2 person-months), (ii) social and/or poverty specialist (3 person-months), (iii) economist (2 person-months), (iv) financial analyst (2 person-months), and (v) environment specialist (1 person-month). The outline terms of reference for consulting services is in Appendix 3.

18. For the second part of TA activities, ADB will recruit a consulting firm using the bio-data technical proposal through a quality- and cost-based selection process, as per ADB guidelines. The following international consultants will be required for the second part: (i) hydropower expert (2 person-months), (ii) geologist (1 person-month), (iii) economist (1 person-month), (iv) environment specialist (1 person-month), and (v) financial analyst (1 person-month). Domestic consultants will include (i) hydropower expert (3 person-months), (ii) geologist (3 person-months), (iii) social and/or poverty specialist (3 person-months), (iv) economist (2 person-months), (v) financial analyst (2 person-months), and (vi) environment specialist (3 person-months). The outline terms of reference for consulting services is in Appendix 3.

19. In the first part of TA, individual consultants will submit their draft reports with associated data and analysis within 6 weeks of mobilization. The final reports will be completed within 12 weeks of mobilization. During the second part of the TA, the consulting firm will submit (i) an inception report within 1 month of TA commencement, (ii) an interim report after 3 months, (iii) a draft final report after 5 months, and (iv) a final report within 6 months of TA commencement. Workshops will be held at each of subproject sites to seek the views of the local community and project beneficiaries on improving the project design. Stakeholder participation will be encouraged through workshops and seminars to discuss and share the results of the TA. Further, workshops will be organized after the submission of each of the milestone reports to seek stakeholders' comments.

#### **IV. THE PRESIDENT'S DECISION**

20. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$500,000 on a grant basis to the Government of the People's Republic of China for preparing the Gansu Heihe Hydropower Development Project, and hereby reports this action to the Board.

## DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p><b>Impact</b></p> <p>A reliable and environmentally clean energy supply supporting economic growth in the rural areas of Gansu province</p>	<p>Increased utilization of renewable energy</p> <p>Augmented power supply to rural communities</p> <p>Developed institutional and financial management action plan</p>	<p>National and provincial statistics</p> <p>Provincial power data</p>	<p><b>Assumptions</b></p> <ul style="list-style-type: none"> <li>• The Government to extend priority and resources to promote clean and renewable energy.</li> <li>• Project design implemented effectively</li> </ul>
<p><b>Outcome</b></p> <p>Project design, feasibility study, and implementation arrangements agreed and suitable for ADB financing</p>	<p>The Government and ADB sign memorandum of understanding of final tripartite meeting</p>	<p>Consultant's final report, memorandum of understanding, back-to-office report of final technical assistance review mission</p>	<p><b>Assumption</b></p> <ul style="list-style-type: none"> <li>• Effective stakeholder participation and ownership developed</li> </ul> <p><b>Risk</b></p> <ul style="list-style-type: none"> <li>• Key stakeholders do not agree with the technical assessment.</li> </ul>
<p><b>Outputs</b></p> <p>1. Technical assessments completed, and design requirements met for the Erlongshan subproject</p> <p>2. Technical assessments completed, and design requirements met for the Dagushan subproject</p>	<p>Part I : Draft reports, week 6 Final reports, week 12</p> <p>Part II Inception report, week 4 Interim report, week 12 Draft final report, week 20 Final report, week 24</p>	<p>Project reports TA reviews Part I, weeks 2, 6, and 10</p> <p>Project reports TA reviews Part II, weeks 4, 16, and 20</p>	<p><b>Assumptions</b></p> <ul style="list-style-type: none"> <li>• No restriction on availability and access to timely information and personnel</li> <li>• No restriction on accessing geographic sites</li> </ul>
<p><b>Activities with Milestones</b></p> <p><b>Part I</b></p> <p>1.1 Analyze regional growth and electricity demand, and assess least-cost options for meeting the demand-supply imbalance in project area (weeks 1–10).</p> <p>1.2 Prepare a problem tree, and the initial project design and monitoring framework (weeks 1–4).</p> <p>1.3 Review and refine project feasibility studies. Finalize project cost, implementation schedule, procurement plan, and procurement packages (weeks 1–6).</p> <p>1.4 Carry out land acquisition and resettlement, social, poverty, ethnic minority, and gender assessment; recommend measures for strengthening project implementation management (weeks 2–8).</p> <p>1.5 Carry out stakeholder workshops (weeks 2, 6, and 10).</p>			<p><b>Inputs</b></p> <p><b>Consulting Services:</b></p> <p><b>Part I</b> 4 person-months of international consultants and 10 person-months of domestic consultants</p> <p><b>Part II</b> 6 person-months of international consultants and 16 person-months of domestic consultants</p>

<p><b>Activities with Milestones</b></p> <p>1.6 Complete a baseline survey (weeks 4–12).  1.7 Carry out financial, economic, and institutional analyses (weeks 6–12).  1.8 Complete resettlement plan, social, poverty, ethnic minority, and gender assessment; develop corporate strategy and the business plan for the project implementing agency; set up project management structure in the implementing agency (weeks 10–12).  1.9 Assess potential for carbon emission reduction under CDM (weeks 6–12).  1.10 Finalize project design and monitoring framework (weeks 10–12).</p>	<p><b>Inputs</b></p> <p><b>Financing: \$650,000</b></p> <p><b>ADB: \$500,000</b></p> <p>Consultants: \$411,000  Equipment: \$15,000  Training, seminars, and conferences: \$12,000  Surveys: \$7,000  Contingencies: \$55,000</p>
<p><b>Part II</b></p> <p>2.1 Prepare a problem tree, and the initial project design and monitoring framework (weeks 1–4).  2.2 Prepare summary EIA (weeks 1–8).  2.3 Review and refine project feasibility studies. Finalize project cost, implementation schedule, procurement plan, and procurement packages (weeks 1–12).  2.4 Carry out land acquisition and resettlement; social, poverty, ethnic minority, and gender assessment; recommend measures for strengthening project implementation management (weeks 4–16).  2.5 Carry out stakeholder workshops (weeks 4, 16, and 20).  2.6 Complete a baseline survey (weeks 10–16).  2.7 Carry out financial, economic, and institutional analyses (weeks 10–20).  2.8 Complete resettlement plan; social, poverty, ethnic minority, and gender assessment; develop corporate strategy and the business plan for the project implementing agency; set up project management structure in the implementing agency (weeks 12–20).  2.9 Assess potential for carbon emission reduction under CDM (weeks 12–20).  2.10 Finalize project design and monitoring framework (weeks 18–20).</p>	<p><b>Government: \$150,000</b></p> <p>Office accommodation and transport: \$60,000  Personnel: \$40,000  Logistics: \$50,000</p>

ADB = Asian Development Bank, CDM = clean development mechanism, EIA = environmental impact assessment, TA = technical assistance.

**COST ESTIMATES AND FINANCING PLAN**  
(\$'000)

Item	Total Cost
<b>1. Asian Development Bank (ADB) Financing<sup>a</sup></b>	
<b>A. Part I</b>	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	75.0
ii. Domestic Consultants	60.0
b. International and Local Travel	15.0
c. Reports and Communications	5.0
2. Training, Seminars, and Conferences	2.0
4. Surveys	2.0
5. Miscellaneous Administration and Support Costs	2.0
6. Contingencies	19.0
<b>Subtotal (A)</b>	<b>180.0</b>
<b>B. Part II</b>	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	110.0
ii. Domestic Consultants	100.0
b. International and Local Travel	30.0
c. Reports and Communications	5.0
2. Equipment <sup>b</sup>	15.0
3. Training, Seminars, and Conferences	10.0
4. Surveys	5.0
5. Miscellaneous Administration and Support Costs	8.0
6. Contingencies	37.0
<b>Subtotal (B)</b>	<b>320.0</b>
<b>Total ADB Financing (A+B)</b>	<b>500.0</b>
<b>2. Government Financing</b>	
1. Office Accommodation and Transport	60.0
2. Remuneration and Per Diem of Counterpart Staff	40.0
3. Others	50.0
<b>Total Government Financing</b>	<b>150.0</b>
<b>Total</b>	<b>650.0</b>

<sup>a</sup> Financed by ADB's technical assistance funding program.

<sup>b</sup> Including four Pentium computers, one photocopier, two laser printers, one digital camera, and one fax machine. The ownership of the equipment will be transferred to the Executing Agency at the completion of the technical assistance.

Source: ADB estimates.

## OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The project preparatory technical assistance (TA) will be implemented in consultation with relevant stakeholders, including (i) Gansu provincial and Zhangye City governments, (ii) relevant government departments and agencies, (iii) relevant local communities, and (iv) development agencies.

2. The project preparatory TA will be carried out in two parts. During the first part, the Asian Development Bank (ADB) will engage individual experts to carry out the activities (paras. 3–8). Each expert will deliver a draft report on relevant tasks within 6 weeks of field mobilization. The final report incorporating stakeholders' comments should be completed within 12 weeks of field mobilization.

### A. First Part of TA

#### 1. International Consultants

3. **Hydropower Expert** (1 person-month). The expert will

- (i) Review the feasibility report for the Erlongshan subproject, and identify key technical challenges and risks that might threaten subproject development, if any.
- (ii) Validate the assumptions made, verify the flow data utilized in the feasibility reports, and optimize the proposed design to reflect the most cost-effective solution for each subproject.
- (iii) Update the cost estimates for each subproject based on relevant international experience, identify procurement packages, and recommend a mode of procurement for these packages.
- (iv) Prepare a project implementation schedule and sequencing of subproject implementation to match the capacity of the Implementing Agency (IA).
- (v) Prepare a subproject procurement plan identifying procurement packages, procurement modes, bidding sequence, and timing.
- (vi) Prepare a due diligence report of technical assessment of the Project, and coordinate with other team members.

4. **Social and/or Poverty Specialist** (1.5 person-months). The social and/or poverty specialist will

- (i) Conduct a site visit to make an initial poverty and social assessment; identify the project stakeholders, and examine their rights and possible risks from the Project; and help build public acceptance of the Project.
- (ii) Assist the power economist in assessing the willingness to pay (WTP) through a structured survey of households in the project area.
- (iii) Provide a statement of the poverty reduction features of the Project, assess the social and gender considerations as part of the project design, prepare a social analysis in accordance with ADB's guidelines for incorporation of social dimensions in ADB operations,<sup>1</sup> determine the likely social and gender effects, identify mitigation measures or complementary activity that could help reduce poverty in the project area, and assess whether ethnic minorities will experience any adverse or disproportionate effects.

<sup>1</sup> ADB. 1997. *Guidelines on Operational Procedures: Incorporation of Social Dimensions in Bank Operations*. Manila.

- (iv) Conduct diligence on the 125 mu of land acquired and 570 mu of land temporarily occupied for the Erlongshan hydropower plant (HPP) to ensure that the acquisition is in accordance with ADB's *Involuntary Resettlement Policy*;<sup>2</sup> and, if any gaps are found, prepare a retrofitted resettlement plan to address them.
- (v) Identify land acquisition requirements (permanent acquisition and temporary land occupation) for the Dagushan HPP; and prepare a resettlement plan in accordance with ADB's *Involuntary Resettlement Policy* (footnote 2) and *Operations Manual on Involuntary Resettlement*,<sup>3</sup> including assessment of the downstream social impacts.
- (vi) Prepare a resettlement framework in accordance with ADB's *Involuntary Resettlement Policy* (footnote 2) and *Operations Manual on Involuntary Resettlement* (footnote 3) to guide the preparation of non-core subproject resettlement plans, if applicable.
- (vii) Assess the pro-poor impacts of the Project, taking into account linked effects; and identify ways to make the Project pro-poor, design a time-bound plan for monitoring, and outline the plan and resources required to implement the monitoring plan.
- (viii) Estimate the number of poor people who will benefit from the Project; estimate the proportion of poor who will benefit from government expenditure; estimate the proportion of net benefits to the economy that directly benefit the poor; calculate the poverty impact ratio; and conduct risk analysis for key variables and assumptions used in calculating the ratio, and explain the implications.

5. **Economist** (1.5 person-months). The power economist will

- (i) Briefly review the sector; and identify and discuss relevant issues, such as electricity pricing, regulatory framework, and system structure at the provincial level.
- (ii) Summarize the current and projected power demand in Zhangye City, Hexi corridor, and Gansu province, including energy consumption, generation, future trends, price, and subsidies.
- (iii) Assess the WTP of consumers in the project area for electricity, in consultation with the social and/or poverty specialist, based on sample survey of energy consumed and price paid by households. The survey also should assess household income.
- (iv) Construct a demand function from the survey data.
- (v) Update the least-cost generation plan, taking into account all forms of energy, including conventional thermal sources, and the proposed hydropower subprojects in Erlongshan and Dagushan.
- (vi) Help the hydropower expert establish least-cost nature of the proposed project.
- (vii) Estimate the incremental electrical energy supplied throughout the life of the project, excluding the technical losses.
- (viii) Estimate economic benefits, based on the WTP and the incremental energy supply.
- (ix) Calculate an economic internal rate of return for the subproject.
- (x) Conduct a sensitivity analysis for plausible scenarios.
- (xi) Identify and analyze likely economic uncertainties that could affect the Project's viability, and carry out a risk analysis.
- (xii) Prepare an initial project design and monitoring framework.

<sup>2</sup> ADB. 1995. *Policy on Involuntary Resettlement*. Manila.

<sup>3</sup> ADB. 2003. *Operations Manual*. Section F2/BP: Involuntary Resettlement. Manila (29 October), para. 2.

## 2. Domestic Consultants

6. During the first part of the TA, a domestic consultant team will be engaged to support the international consultants. The domestic team will comprise (i) hydropower expert (2 person-months), (ii) a social and/or poverty specialist (3 person-months); (iii) economist (2 person-months); (iv) financial analyst (2 person-months), and (v) environment specialist (1 person-month). The domestic consultants will have extensive knowledge of the project area. In addition, they will help the international consultants to become quickly familiar with their tasks by reviewing relevant reports, analytical data, policies, and regulations, and translating relevant documents into English. Further, only domestic experts will be engaged for the following tasks under ADB supervision.

7. **Financial Analyst** (2 person-months). In accordance with the *Guidelines for the Financial Governance and Management of Investment Projects Financed by the Asian Development Bank* (2005),<sup>4</sup> the consultant will refine and finalize the financial analysis of Erlongshan subproject and financial performance of the IA. Specifically, the financial analyst will

- (i) Carry out in-depth financial analysis of the Erlongshan subproject (and its defined components), including calculation of the financial internal rate of return and weighted average cost of capital, taking into account all the financial costs and benefits.
- (ii) Identify all risks to project revenue and costs, and conduct relevant sensitivity analyses on the financial results.
- (iii) Prepare a project cost estimate, base cost, physical and price contingencies, interest during construction, commitment fee, and other financing charges.
- (iv) Prepare a financing plan for the Project, including proposed ADB lending, any prospective cofinancing, and appropriate counterpart funds.
- (v) Review the most current audited and/or unaudited financial statements of the IA, if available, to assess (a) historical financial performance, (b) retail tariff levels, (c) capital structure, and (d) sufficient generation of internal funds to ensure sustainability of ongoing operations (i.e., the ability to self-finance a reasonable percentage of capital expenditures and service existing debt). The consultant also will review recent audited project accounts of the IA to determine proper accounting and cost control.
- (vi) Prepare an appendix to the report and recommendation of the President, briefly summarizing historical and projected financial performance, which will include 10-year pro forma financial statements (balance sheet, income statement, and statement of cash flows) for IA, if applicable.
- (vii) Recommend appropriate financial performance measures/ratios for the IA, and assess compliance with such measures/ratios in pro forma statements.
- (viii) Assess the IA's financial management capabilities, and make recommendations for institutional strengthening of financial management with a recommended time-bound implementation plan.

8. **Environment Specialist** (1 person-months). The environment specialist will coordinate and support field activities of international and domestic social and/or poverty experts. The consultant will

- (i) Update and refine the summary environmental impact assessment, if required.
- (ii) Assist the social and/or poverty experts in their field activities.

<sup>4</sup> ADB. 2005. *Guidelines for the Financial Governance and Management of Investment Projects Financed by the Asian Development Bank*. Manila.

- (iii) Review the environmental management capabilities of the Executing Agency (EA) and the local environmental monitoring units, and recommend institutional strengthening measures, if required.

## **B. Second Part of TA**

9. For the second part of TA activities, a team of international consultants (6 person- months) will coordinate their work with the domestic consultants (16 person-months). The consulting team of international consultants will comprise (i) hydropower expert, (ii) geologist, (iii) economist, (iv) environment specialist, and (v) financial analyst. The domestic consultants will have similar areas of specialization as the international consultants, and will include a social and/or poverty specialist as well. The international hydropower expert will be the team leader, and will allocate tasks among the consulting team members. The team leader will be responsible for overall coordination of TA activities.

### **1. International Consultants**

10. **Hydropower Expert** (2 person-months). The hydropower experts will undertake similar tasks for Dagushan hydropower subproject as identified in para. 3 for the hydropower expert in the first phase for Erlongshan subproject.

11. **Geologist** (1 person-month). The geologist, in coordination with the hydropower expert and the domestic geologist, will

- (i) Review the geological investigation report for major project sites—intake weir, tunnel, power house, etc.
- (ii) Assess the adequacy and robustness of the geological analysis, and identify any significant risks to project structures.
- (iii) Identify an action plan to mitigate identified risks.
- (iv) Discuss the findings with the provincial design institute and project IA agency, and submit a report.

12. **Economist** (1 person-month). During the second part of the TA, the power economist will carry out tasks similar to those identified for the first part of the TA (para. 5), except the tasks related to the least-cost study for Erlongshan and Dagushan subprojects that will be carried out in the first part itself.

13. **Environment Specialist** (1 person-month). The environment specialist will

- (i) Prepare the summary environmental impact assessment for Dagushan subproject in accordance with ADB's *Environment Policy* (2002)<sup>5</sup> and *Environmental Assessment Guidelines* (2003).<sup>6</sup>
- (ii) Undertake a cumulative impact assessment of Erlongshan and Dagushan subprojects, and make an overall impact assessment of the Heihe River Cascade Plan (seven proposed HPP sites in Zhangye City).
- (iii) Review the environmental management capabilities of the EA and the local environmental monitoring units, and recommend institutional strengthening measures, if required.
- (iv) Assess the global environmental benefits of the Project in terms of reduction of greenhouse gas (GHG) emissions, assess in monetary terms the value of the

<sup>5</sup> ADB. 2002. *Environment Policy*. Manila.

<sup>6</sup> ADB. 2003. *Environmental Assessment Guidelines*. Manila.

same (i.e., GHG emission reduction credits), and identify the certification requirements to enable the international trading of the GHG emission reduction credits. The specialist will also prepare project design documents for each subproject suitable for submission to the Clean Development Mechanism Executive Board.

- (v) The consultant will assist the EA in conducting appropriate public consultation, as required, in accordance with the ADB's *Environment Policy* (footnote 5) and *Environmental Assessment Guidelines* (footnote 6).

14. **Financial Analyst** (1 person-month). The financial analyst will undertake similar tasks for the Dagushan subproject as those specified for the domestic financial analyst for the first part of the TA (para. 7). In addition, the international financial analyst for the second part will conduct due diligence on the analysis of Erlongshan hydropower subproject in the first part of the TA.

## 2. Domestic Consultants

15. During the second part of the TA, the domestic consultant team will be engaged to support the international consultants. The domestic team will comprise (i) hydropower expert (3 person-months), (ii) geologist (3 person-months), (iii) economist (2 person-months), (iv) environment specialist (3 person-months), and (v) financial analyst (2 person-months). The domestic consultants will have extensive knowledge of the project area. Further, they will help the international consultants to become quickly familiar with their tasks by reviewing relevant reports, analytical data, policies, and regulations, and translating relevant documents into English.

16. In addition, only a domestic expert will be engaged as the social and/or poverty specialist (3 person-months) for the following tasks:

- (i) Provide a statement of the poverty reduction features of the Project, assess the social and gender considerations as part of the project design, prepare a social analysis in accordance with ADB's *Guidelines for Incorporation of Social Dimensions in ADB Operations*,<sup>7</sup> determine the likely social and gender effects, identify mitigation measures or complementary activity that could help reduce poverty in the project area, and assess whether ethnic minority nationalities will experience any adverse or disproportionate effects.
- (ii) Make an assessment of land acquisition and resettlement issues associated with the Erlongshan subproject, and prepare a short resettlement plan to address them during the project design.
- (iii) Assess the pro-poor impacts of the Project, taking into account linked effects; and identify ways to make the Project pro-poor, design a time-bound plan for monitoring, and outline the plan and resources required to implement the monitoring plan.

<sup>7</sup> ADB. 1997. *Guidelines on Operational Procedures: Incorporation of Social Dimensions in Bank Operations*. Manila.