



Completion Report

Project Number: 34476-01
Loan Number: 2032
August 2009

People's Republic of China: Gansu Clean Energy Development Project

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

		At Appraisal	At Project Completion
		10 November 2003	15 May 2009
CNY1.00	=	\$0.12	\$0.15
\$1.00	=	CNY8.3	CNY6.8

ABBREVIATIONS

ADB	–	Asian Development Bank
CER	–	certified emission reduction
CO ₂	–	carbon dioxide
EA	–	executing agency
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
GDP	–	gross domestic product
HHDC	–	Heihe Hydropower Development Company
IA	–	implementing agency
LIBOR	–	London interbank offered rate
O&M	–	operation and maintenance
PRC	–	People's Republic of China
TA	–	technical assistance
XHC	–	Xiaogushan Hydropower Company
XHP	–	Xiaogushan hydropower plant
WACC	–	weighted average cost of capital

WEIGHTS AND MEASURES

GWh	–	gigawatt-hour
km	–	kilometer
kV	–	kilovolt
kWh	–	kilowatt-hour
m ³ /s	–	cubic meters per second
MW	–	megawatt

NOTES

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

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BASIC DATA

A. Loan Identification

1.	Country	People's Republic of China
2.	Loan Number	2032
3.	Project Title	Gansu Clean Energy Development Project
4.	Borrower	People's Republic of China
5.	Executing Agency	Gansu provincial government
6.	Amount of Loan	\$35,000,000.00 (\$963,917.49 canceled on 2 September 2008)
7.	Project Completion Report Number	PCR: PRC 1110

B. Loan Data

1.	Fact-finding (appraisal waived)	
	– Date Started	15 January 2003
	– Date Completed	24 January 2003
2.	Loan Negotiations	
	– Date Started	27 October 2003
	– Date Completed	30 October 2003
3.	Date of Board Approval	5 December 2003
4.	Date of Loan Agreement	27 April 2004
5.	Date of Loan Effectiveness	
	– In Loan Agreement	27 July 2004
	– Actual	4 August 2004
	– Number of Extensions	1
6.	Closing Date	
	– In Loan Agreement	30 April 2008
	– Actual	2 September 2008
	– Number of Extensions	0
7.	Terms of Loan	
	– Interest Rate	London interbank offered rate (LIBOR)–based
	– Maturity (number of years)	24
	– Grace Period (number of years)	4
8.	Terms of Relending (if any)	
	– Interest Rate	LIBOR-based
	– Maturity (number of years)	24
	– Grace Period (number of years)	4
	– Second-Step Borrower	Gansu Zhangye Xiaogushan Hydropower Company

9. Disbursements

a. Dates

Initial Disbursement	Final Disbursement	Time Interval
4 August 2004	19 December 2007	48 months
Effective Date	Original Closing Date	Time Interval
4 August 2004	30 April 2008	45 months

b. Amount (\$ million)

Category	Original Allocation	Last Revised Allocation	Amount Disbursed	Undisbursed Balance^a
1 Civil Works	14.5	16.6	16.9	(0.3)
2 Equipment	15.4	11.2	10.8	0.4
3 Institutional Strengthening	0.7	2.2	2.2	0.0
4 Supervision	0.3	1.2	0.9	0.3
5 Front-End Fee	0.2	0.2	0.2	0.0
6 IDC	3.7	3.7	3.0	0.6
7 Unallocated	0.2	0.0	0.0	0.0
Total	35.0	35.0	34.0	0.9

IDC = interest during construction.

Note: Because of rounding, figures may not add up to the totals given.

^a Canceled at loan closing.

10. Local Costs (Financed): None

C. Project Data

1. Project Cost (\$ million)

Cost	Appraisal Estimate	Actual
Foreign Exchange Cost	35.0	34.0
Local Currency Cost	52.0	59.3
Total	87.0	93.4

Note: Because of rounding, figures may not add up to the totals given.

2. Financing Plan (\$ million)

Cost	Appraisal Estimate	Actual
Implementation Costs		
Borrower-Financed	8.8	14.7
ADB-Financed	31.1	30.8
Other External Financing	38.0	40.2
Total	77.9	85.7
IDC Costs		
Borrower-Financed	5.2	4.4
ADB-Financed	3.9	3.2
Other External Financing	0.0	0.0
Total	9.1	7.6

ADB = Asian Development Bank, IDC = interest during construction.

3. Cost Breakdown, by Project Component (\$ million)

Component	Appraisal Estimate	Actual
A. Base Cost		
1. Hydropower Plant		
a. Civil Works	53.6	59.2
b. Power Plant Equipment	12.7	12.6
c. Environment Protection	0.6	0.7
d. 110 kV Transmission Line	2.3	2.3
e. Designing and Supervising	4.1	3.1
2. Rural Electrification	0.9	1.3
3. Institutional Strengthening	0.7	4.0
4. Land and Others	0.0	2.5
Subtotal (A)	74.9	85.7
B. Contingencies		
1. Physical Contingencies	2.0	0.0
2. Price Contingencies	1.1	0.0
Subtotal (B)	3.1	0.0
C. Financial Charges during Development^a	9.0	7.7
Total	87.0	93.4

kV = kilovolt.

^a Including front-end fee, interest during construction, and commitment charges.

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants	June 2004	September 2004
Completion of Engineering Designs	December 2003	September 2003
Civil Works Contract		
Date of Award	October 2003	February 2004
Completion of Work	October 2006	July 2006
Equipment and Supplies		
Dates		
First Procurement	April 2004	May 2004
Last Procurement	April 2005	May 2006
Completion of Equipment Installation	October 2006	June 2006
Start of Operations		
Completion of Tests and Commissioning	January 2007	July 2006
Beginning of Start-Up	October 2007	October 2007

5. Project Performance Report Ratings

Implementation Period	Ratings	
	Development Objectives	Implementation Progress
5 December 2003 to 31 July 2005	Satisfactory	Satisfactory
1 August 2005 to 30 June 2006	Satisfactory	Highly Satisfactory
1 July 2006 to 31 August 2007	Highly Satisfactory	Highly Satisfactory
1 September 2007 to 31 August 2008	Highly Satisfactory	Satisfactory

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members
Fact-Finding Mission	15–24 January 2003	6	48	a, b, c, d, e, f
Inception Mission	24–28 February 2004	3	12	g (2), h
Loan Review Mission	13–20 November 2004	5	95	e, f, g, h, i
Loan Review Mission	17–24 October 2005	4	28	f, j, k, l
Loan Review Mission	17–20 March 2006	2	6	f, l
Midterm Review	27–31 July 2006	3	12	f, j, l
Loan Review Mission	9–13 July 2007	4	16	f (2), h, j
Project Completion Review	4–11 May 2009	4	31	d, f, h, k

a = engineer or consultant, b = financial analyst, c = economist, d = environment specialist or consultant, e = social development specialist or consultant, f = project officer, g = energy specialist, h = project analyst, i = external relations officer, j = finance officer, k = resettlement officer, l = project assistant.





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I. PROJECT DESCRIPTION

1 Zhangye City, about 600 kilometers (km) northwest of Lanzhou, the capital of Gansu Province, has struggled to develop in the face of a serious energy shortage. Supply deficits and power outages have long plagued local industries and the city's 1.2 million residents. The construction of the Xiaogushan hydropower plant (XHP) under the Gansu Clean Energy Development Project was expected to help deal with the problem, improve the environment in Zhangye City by making clean energy more accessible, and bring economic development within closer reach. The sixth hydropower plant in the cascade development of hydraulic power along the Heihe River,¹ the XHP was a medium-sized third-level project with an initial design capacity of 98 megawatts (MW), and average annual generation of 391 gigawatt-hours (GWh) of electricity. The plant was to be built in the remote poor rural area of Zhangye City, on the lower segment of Heihe valley in Sunan County.

2 Besides the construction of the XHP, which would make electricity available through the Hexi corridor grid, the Project would involve (i) rural electrification, through two 35 kV transmission lines to the townships of Xishui, Huazhai, and Anyang; and (ii) institutional strengthening of the implementing agency (IA), including support for project management, financial management, and enterprise reform. On 5 December 2003, the Asian Development Bank (ADB) approved a \$35 million loan for the Project from its ordinary capital resources. Appendix 1 shows the project framework at appraisal and the achievements at completion, and Appendix 2 traces the history of the Project.

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

3 Heavy dependence on coal as an energy source causes substantial harm to the environment. Recognizing that fossil-fuel dominance is neither environmentally sustainable nor economically desirable, the Government of the People's Republic of China (PRC) is strongly committed to improving energy efficiency, developing renewable sources to diversify the country's energy supply mix, reducing emissions, and lessening the adverse effects of global warming and climate change, and it has set mandatory targets and adopted incentive-based policies as proof of its commitment.

4 The energy sector has been a priority area for ADB since it started lending to the PRC in 1987. ADB's energy sector operations in the country have evolved from capacity addition in traditional power generation and transmission projects to advanced-technology pioneering clean-energy projects with substantial demonstration effects. ADB's and the Government's

¹ The Heihe River cascade hydropower development scheme is a large infrastructure project made up of seven discrete run-of-river medium hydropower projects. A total of 645.5 megawatts (MW) of hydropower capacity will become available through the scheme, which began construction in 1996. Of the seven hydropower projects, five are already in operation and two are being built. ADB has supported two other hydropower projects in the scheme besides the XHP. The projects were packaged as the first multitranche financing facility (MFF) in the PRC (\$50 million): (i) first tranche (\$22 million), Erlongshan Hydropower Project (50.5 MW), under Loan 2296-PRC: MFF-Gansu Heihe Rural Hydropower Development Investment Program (Project 1); and (ii) second tranche (\$28 million), Dagushan Hydropower Project (65 MW), under Loan 2408-PRC: MFF-Gansu Heihe Rural Hydropower Development Investment Program (Project 2). ADB. 2006. *Report and Recommendation of the President to the Board of Directors on a Proposed Multitranche Financing Facility to the People's Republic of China for the Gansu Heihe Rural Hydropower Development Investment Program*. Manila.

sector priorities fully converge. Energy is one of five core operational areas, and environmental sustainability one of three strategic development priorities, in ADB's long-term strategic framework (Strategy 2020).² ADB's operational focus for the energy sector hinges on addressing energy security and climate change by improving energy efficiency and expanding the use of indigenous clean and renewable energy. The country partnership strategy for the PRC (2008–2010) concentrates on achieving balanced and sustainable growth with more efficient use of resources and more stringent protection of the environment.³

5 The Project was consistent with the Government's strategy of developing clean energy and restructuring the energy sector. It was also in harmony with the Government's plan to speed up economic development in Zhangye City by providing a reliable supply of electricity to local agriculture and cottage industries, and to reinforce the availability and reliability of power supply in the electricity grid. Hydropower development has increased power generation, made electric power supply more efficient and reliable, and improved environmental quality, thereby directly and indirectly accelerating economic growth and reducing poverty.

6 The project design was sound. It was formulated with project preparatory technical assistance (TA),⁴ and consultants' (national and international) and on-the-job training support for project management and implementation. The TA was provided in answer to a request, made by the PRC Government during the 2001 country programming mission, for assistance in developing hydropower and clean energy in Gansu Province. The need for policy and institutional reforms for the purpose and the feasibility of investment programs were explored. The TA provided all the inputs needed to prepare the Project for ADB financing. Overall, the quality of the TA was highly satisfactory.

B. Project Outputs

7 **Xiaogushan Hydropower Plant.** The XHP component included all the necessary civil works and equipment to complete the hydropower facility and connect it to a 110 kilovolt (kV) intermediate (or service) substation. The component had the following subcomponents: (i) civil works, (ii) service road improvements, (iii) power plant equipment, (iv) hydromechanical equipment and metal structures, (v) environmental management, (vi) construction utilities, (vii) transmission lines (27 km) to the 110 kV substation to be built adjacent to the Longshou phase II project downstream, and (viii) design and supervision. The XHP was a key energy development project in the 10th Five-Year Plan for Zhangye City, and was consistent with the sustainable growth of the renewable energy subsector. The initial design capacity of the power station was 98 MW (2x 40 MW, plus 1 x 18 MW) and the estimated average annual electricity generation was 391 GWh. But shortening the division tunnel by 300 m and lowering the tunnel lining roughness factor resulting from lining optimizing during construction increased the capacity of the 18 MW electricity generating unit to 22 MW. The total design capacity therefore increased to 102 MW, the long-time average annual generation to 396 GWh, and the annual utilization time to 3,882 hours. The XHP generated 481.26 GWh in 2007 and 439.6 GWh in 2008. From 2009 onward, annual operation time is conservatively assumed to be 3,882 hours, and annual generation 396 GWh. The plant has been operating satisfactorily.

² ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008–2020*. Manila.

³ ADB. 2008. *Country Partnership Strategy (2008–2020): People's Republic of China*. Manila.

⁴ ADB. 2001. *Technical Assistance to the People's Republic of China for Preparing the Gansu Hydropower Project*. Manila (TA 3730-PRC, \$950,000, approved on 27 September 2001).

8 **Rural Electrification.** In the initial design, two 35 kV lines were to be built in association with the XHP to transmit electricity from the plant to Xishui, Huazhai, and Anyang townships. But a 35 kV transmission line built from Longshou to Xiaogushan to provide standby power for the construction of the Project also supplied power to Xishui Township, and a 35 kV transmission line to Anyang and Huazhai townships was included in a comprehensive upgrading program of the Zhangye City government for rural power grids. The power supply problem in the three townships was therefore fully solved with domestic funds at the early stages of the project implementation.

9 **Institutional Strengthening.** Institutional strengthening under the Project, the first ADB loan project in Gansu Province, was meant to ensure that the IA, the Xiaogushan Hydropower Company (XHC), had enough capacity to implement the Project. This component was carried out from 2003 to 2006. The consultant assisted XHC in training its staff in financial management, project management, and ADB loan policies and procedures throughout the project implementation period. With the consultant's help, XHC and its parent company, the Heihe Hydropower Development Company (HHDC), drafted a corporate strategy to guide the future development of XHC and HHDC.

C. Project Costs and Financing Plan

10 The actual project cost was \$93.4 million, 7% higher than the \$87.0 million estimated at appraisal. The increase in cost was mainly due to the appreciation of the yuan. ADB financed \$34.0 million of the cost, and stakeholders and local banks provided timely counterpart funding of \$59.3 million.

11 The proportions financed from different sources—ADB loan, domestic loan, and equity capital—were not significantly different from the appraisal estimates. Equity capital accounted for 20.5% of the total funding, compared with 16.1% at appraisal. The project cost and financing plan is in Appendix 3.

D. Disbursements

12 Loan proceeds were withdrawn according to ADB's standard disbursement procedures. Disbursements totaled \$34,036,082.51, 97% of the net ADB loan. An imprest account was opened with an initial disbursement of \$800,000 from ADB on 16 September 2004. The average annual turnover ratio for the imprest account over the implementation period was about 1. Four major disbursement procedures were adopted effectively during project implementation. Direct payment and commitment procedures were mainly used for equipment contracts, and reimbursement and imprest account procedures for equipment procurement and civil works contracts. Overall, disbursement was consistent with the physical implementation schedule and annual disbursement projections. Appendix 4 shows the actual contract awards and disbursements.

E. Project Schedule

13 ADB approved a \$35.0 million loan for the Project from its ordinary capital resources on 5 December 2003, and the Loan Agreement was signed on 27 April 2004 and took effect on 4 August 2004. Preconstruction activities—detailed design, preparation of bidding documents, tendering and awarding of contracts, and construction of critical diversion tunnel works—started in January 2003 and were completed by February 2004. XHP construction started in October

2003. The three generating units were commissioned in May–July 2006, about 6 months ahead of the appraisal schedule. By 31 October 2007, the Project had been fully implemented, as scheduled. The loan closed on 2 September 2008; the balance in the imprest account was refunded to ADB and the loan balance was canceled. Appendix 5 compares the actual implementation schedule with the schedule envisaged at appraisal.

F. Implementation Arrangements

14 The Gansu provincial government was the executing agency (EA) for the Project. The implementing agency was XHC, a joint-stock company set up in 2001 by HHDC (66%) and the Zhangye Water and Power Bureau (34%), in line with the Company Law of the PRC, to undertake project development. A project director, reporting directly to the XHC president, took charge of overall project management, approval of contracts, and payments. A project management office was created within XHC to facilitate land acquisition, carry out social and environmental protection measures, and address local concerns. The engineering team set up office in a new building at the power station site. The office was headed by a XHC project manager, who was responsible for day-to-day implementation and for the preparation of progress reports.

15 The important operational groups were the Planning, Engineering, and Finance departments. The Planning Department prepared the monthly construction progress plans and purchase requirements, and supervised the delivery of materials. The Engineering Department, which was responsible for overall physical construction and installation, dealt with routine management and coordination works, and carried out quality inspections. The Finance Department was in charge of project financing and project capital funding, payment of the contracted price, and project financial settlement; it assisted with project auditing work and financial management work related to the ADB loan.

16 The implementation arrangements were highly satisfactory, and worked as envisaged at appraisal. The project management, financial management, and performance management capacity of the IA was strengthened through domestic training, overseas study tours, and consulting services. The experience from the Project enabled HHDC to build two other hydropower plants along the Heihe River, which also received financing support from ADB (footnote 1). The project organization chart at project completion is in Appendix 6.

G. Conditions and Covenants

17 All major loan covenants concerning implementation arrangements, reporting, environmental protection, social and resettlement, economic and financial, have been complied with or are being complied with. No loan covenant was modified, suspended, or waived. Project reporting was adequate. All required monitoring and evaluation reports, including audited project accounts and audited financial statements, were submitted on time and in good quality. Appendix 7 presents the status of compliance with the loan covenants.

H. Consultant Recruitment and Procurement

18 The contract for consulting services was signed between the XHC and the consulting company GHD in September 2004, and two supervision contracts were signed with Yellow River Engineering Consulting Company and China Northwest Water Conservancy and Hydropower Engineering Consulting Company. About 14 person-months of international

consulting services and 637 person-months of national consulting services in construction supervision were provided. An effective reporting system was established to allow XHC to supervise, monitor, and improve the performance of the contractors.

19 The Government asked ADB to approve advance action to expedite the recruitment of consultants and procurement for civil works and critical equipment. ADB Management approved this request in May 2003, and also approved on 11 September 2003 the Government's request for up to \$3.5 million in retroactive financing for equipment and civil works for the period between 1 October 2003 and the time the loan would take effect. Sixty-three contract packages financed by ADB—26 for civil works, 32 for equipment, and 5 for consulting services, design, and supervision—were procured according to ADB's *Procurement Guidelines* (2007, as amended from time to time). XHC hired China International Tendering Company to act as tendering agent for international and national competitive bidding. Procurement presented no major problems. Appendix 8 shows the updated status of procurement.

I. Performance of Consultants, Contractors, and Suppliers

20 The performance of the consultants, contractors, and suppliers was generally satisfactory. As the international consulting firm for the Project, GHD made important comments on the construction, and organized training in financial management, computer management, and project management as well as overseas studies for staff. GHD also assisted XHC in preparing and submitting quarterly progress reports and annual project performance evaluation reports, which strengthened project implementation. The two construction supervision companies—Yellow River Engineering Consulting Company and China Northwest Water Conservancy and Hydropower Engineering Consulting Company—ably supervised project quality and progress, and controlled and coordinated project funding. They also prepared monthly supervision reports, which brought problems to the attention of XHC. Their role was not only critical to the project outcome but also well accepted by XHC and the construction companies. Civil works constructed by national contractors were completed satisfactorily and according to contract specifications and quality requirements. The suppliers of equipment likewise performed satisfactorily. The units were delivered on schedule, although some had to be returned for repairs, affecting the project construction schedule to some extent.

J. Performance of the Borrower and the Executing Agency

21 The performance of the Borrower, the EA, and the IA was highly satisfactory. They met their responsibilities and obligations during project implementation. The schedule, quality, and cost of construction were controlled well. The Gansu provincial government provided full support throughout. The IA had enough experienced staff and managed the Project efficiently. Adequate counterpart funds were provided on time.

K. Performance of the Asian Development Bank

22 ADB managed and administered the Project satisfactorily overall. Its eight missions⁵ involving 248 staff-days are considered adequate. ADB delegated project administration to the PRC Resident Mission on 28 December 2004. Communication between ADB and the EA improved as a result, and implementation issues were resolved more quickly and efficiently. The midterm review mission conducted by the resident mission in July 2006 was highly effective. It

⁵ Fact-finding, inception, midterm review, project completion review, and four review missions were held.

provided clear guidance and action plans for resolving key issues in financial management, environment and resettlement monitoring, benefit monitoring, and reporting. Overall, ADB cooperated well with the EA and the IA. XHC faced no major problems in dealing with ADB missions and staff. Many ADB officials visited the project site, brought new ideas, and gave concrete advice. ADB officials were personally involved in packaging project contracts, giving advice on the preparation of documents for loan disbursements, and training project staff in procurement bidding, contract management, and fund disbursement. ADB's engagement furthered ties with XHC, which is located in a relatively poor area, and thereby benefited not only the company and the Project but also Zhangye City as a whole.

23 But ADB could have paid more attention to one issue. Six ADB project officers, one after another, were responsible for the Project. This high turnover of staff hindered communication, especially in the early stages of the Project.

III. EVALUATION OF PERFORMANCE

A. Relevance

24 The Project was highly relevant to the immediate as well as the long-term objectives of the Government and ADB's country strategy. Environmental improvements related to clean energy were its strength. Over time, the Project evolved into a multicomponent effort to improve the environment while serving the needs of the poor in particular. Poverty reduction in Zhangye City is governed by the strategy stated in the "Overall Program of Poverty Reduction and Development in Gansu Province (2001–2010)" drawn up by the provincial government. The plan attributes the continued poverty in the province to the extreme natural conditions, poor infrastructure, and low human capital. Hence, the Project concerned itself mainly with improving (i) infrastructure particularly rural roads, electricity supply, and communications; (ii) environmental protection and rehabilitation; and (iii) social service delivery. The Zhangye City government's commitment to develop the project area, protect the environment, and reduce poverty strengthened the Project. Various environmental improvements, such as the closure of an old coal-fired power plant, benefits harnessed through the Clean Development Mechanism, and energy conservation, were part of the Project. The Project is therefore rated highly relevant.

B. Effectiveness in Achievement of Purpose

25 Energy shortages weighed down Zhangye City's economy, local industries, and 1.2 million residents for a long time. Power outages were common. In 2002, power generation was only 386 million kWh, while power consumption was 972 million kWh. The underdeveloped power industry could not support rapid economic growth. To solve this problem the government had to procure external power supply. But it was not able to work out the problem till 2005. That year, according to statistics from the Zhangye Grid Company, power generation rose sharply to 1.414 billion kWh, and power consumption to 1.33 billion kWh. The power shortage has been overcome. The power now generated not only meets local requirements but is also transmitted to the regional power grid. The grid company expects power demand to grow by 11.1% yearly and total power consumption to reach 2.84 billion kWh by 2015.

26 Hydropower made up 97.24% of total electricity generation in the city in 2005, 46.17% in 2006, 34.55% in 2007, and 39.78% in 2008. Power from the project facilities accounted for 4.07% of total electricity generation in the city in 2006, 8.03% in 2007, and 7.73% in 2008.

Obviously, the Project has increased power generation in the city and guaranteed a stable supply of electricity, especially to the rural areas. The increase in both power generation and power consumption helped optimize industrial infrastructure and promote sustainable economic development. According to data from the Zhangye Municipal Statistical Bureau, the primary sector accounted for 37% of industry output in 2002, the secondary sector for 29%, and the tertiary sector for 34%. By 2008, the proportions had changed to 29% (primary), 38% (secondary), and 33% (tertiary), and gross domestic product (GDP) had increased from CNY7.573 billion in 2002 to CNY16.986 billion, or by an average of around 14% yearly .

27 The development of clean energy, resulting in increased energy generation and in more-reliable and more-efficient supply, helps reduce poverty. The Project encouraged greater use of indigenous renewable energy, improved corporate governance and management in the implementing agency, provided opportunities for job creation and income growth, increased fiscal revenues, upgraded local infrastructure, protected the regional ecology, and thus contributed to poverty reduction and sustainable development in the project neighborhood. The Project fully achieved its development objectives of improving the environment in Zhangye City by making clean energy more accessible. The Project is therefore rated highly effective.

C. Efficiency in Achievement of Outputs and Purpose

1. Efficiency of Investments

28 The Project's financial and economic internal rates of return (FIRR and EIRR) were reevaluated on the basis of the final cost estimates and financing plan, operation and maintenance (O&M) costs, and tariffs (Appendix 9). Mainly because of higher generation capacity, the FIRR for the Project, at 8.7%, is higher than the 7.5% estimated at appraisal despite a tariff that is slightly lower than the appraisal estimate. The after-tax weighted average cost of capital (WACC) is based on the actual capital mix and the cost of various sources of financing. The London interbank offered rate (LIBOR) 10-year fixed swap rate, plus a spread of 0.6% for the ADB loan, 5.98% interest on the domestic loan, and 12% cost of equity investment, was used in the calculation. The recalculated WACC is 3.1%. The Project's FIRR being higher than the WACC, the Project is considered financially viable. Sensitivity analysis indicates that the Project will remain viable even with a 20% decrease in revenue or a 20% increase in O&M costs, or a combination of such adverse conditions. Therefore, the Project is rated highly efficient financially.

29 The reevaluated EIRR for the Project is 27.1%, compared with 23.4% estimated at appraisal (Appendix 10). The higher EIRR is attributed to the larger power generation volume and greater willingness to pay. Sensitivity analysis was carried out to test the impact of (i) an increase in O&M costs, (ii) a decrease in benefits, and (iii) a combination of these two scenarios. According to the analysis, the Project will continue to be economically robust even under these conditions. The Project is therefore rated highly efficient economically.

2. Efficiency of Process

30 ADB's internal processing and support during implementation was efficient and satisfactory. However, the high turnover of ADB project officers responsible for the Project hampered communication, especially in the early stages of the Project. The organization and management of the EA and the IA were highly effective and timely. The hydropower plant was

commissioned about 6 months ahead of schedule. The actual electricity output exceeds the design capacity. On this basis, the Project is rated efficient.

D. Preliminary Assessment of Sustainability

31 The Project has increased power generation in Zhangye City and guaranteed a stable supply of electricity, especially to the rural areas. Increased supply and consumption of electricity have in turn optimized the local industrial structure and stimulated the development of local economy in a sustainable way. From 2002 through 2007, when the Project was being implemented, the city's GDP grew by up to 14% yearly on average, higher than the average rate for the country in the same period. The project FIRR is 8.7 % and the EIRR is 27.1%; both are better than the relevant criteria set forward by ADB. Based on the current assumptions and forecast, almost all the financial indicators are in line with the requirements set forth in the Loan Agreement. This means that the financial targets established at appraisal are achievable in the long run. The project facilities were built according to the required standards and specifications. They are considered to be of sufficient quality to ensure that the project benefits are continuously achieved over the long term. The Project is therefore rated most likely to be sustainable.

E. Impact

1. Environmental Impact

32 As envisaged at appraisal, the Project produced positive environmental impact and benefits. It supplanted the small coal-fired generating units (8.5 MW in total capacity), which were closed. The Project ensured reliable supply of electricity to Zhangye and contributed to the poverty reduction program of the local government. Clean Development Mechanism benefits were realized in the Project (Appendix 11).

33 During construction, all the contractors fulfilled their obligation to protect the environment and implement mitigation measures in their construction schemes. The adverse effects of the project construction on the surrounding environment were thus minimized. The operation of the hydropower plant had very little negative impact on the environment. Necessary environmental management approaches have been integrated into the regular operation of the plant. In addition, the Project will produce significant environmental benefits by providing clean energy and reducing air pollution from conventional coal-fired power plants. Appendix 12 gives a summary assessment of the impact of the Project on the environment.

2. Resettlement

34 The resettlement was first implemented in early 2002 and was completed by the end of 2005. In total, 639.7 mu of land was permanently acquired (332% more than what was estimated in the resettlement plan) and 284.8 mu was temporarily used (120% more than what was planned).⁶ The amount of land that was permanently acquired significantly increased for the following reasons: (i) 472 mu of wasteland in the reservoir area, for the reservoir, connection road, and the transmission line, was not included in the resettlement plan; (ii) 50 mu of land behind the power plant became less accessible after project construction and therefore required

⁶ A mu is a Chinese unit of measurement (1 mu = 666.67 square meters).

compensation; and (iii) 24.8 mu of forestland that belonged to the State was not included in the resettlement plan. In addition, the amount of land in temporary use increased from 129.2 mu to 284.8 mu because of changes made in the design of some subcomponents during project implementation. By the end of 2005, the affected people had been resettled and fully compensated. The compensation generally exceeded the rates stated in the resettlement plan. In addition to cash compensation for grassland acquired for the Project, XHC provided annual fodder subsidy to seriously affected households, to mitigate the loss of fodder from the acquired land.

35 The total actual cost of land acquisition and resettlement was CNY671,193, 336% of the CNY200,000 estimated in the resettlement plan, mainly because the costs of resettlement monitoring and some other management fees were not included in the resettlement plan. The land acquisition and resettlement costs were funded by XHC. The external resettlement monitoring report prepared in 2007 concluded that the project impact on affected households was limited, and that the households had stable livelihoods and productive status. In general, the land acquisition and resettlement were implemented well. Appendix 13 gives a summary assessment of the impact of resettlement.

3. Social Impact

36 The Project has contributed to sustainable regional socioeconomic development, poverty reduction, and community development in the project areas. The construction and operation of the XHP has helped to fill the deficits in electricity supply, improved the reliability of supply during peak hours, and thereby contributed to regional economic growth. Statistics show that socioeconomic conditions in Zhangye City have improved rapidly in recent years. From 2002 to 2007, per capita GDP increased by 93%, from CNY5,979 to CNY11,514, or by an average of 14% yearly. Per capita government fiscal revenues increased by 118%, from CNY381 to CNY832, or by 16.9% yearly on average. Rural per capita net income grew by 34%, from CNY3,092 to CNY4,137. In addition, a special community development plan formulated and implemented under the Project directly benefited the local minorities.

37 The incidence of poverty in the project area has been reduced significantly since the Project was implemented. The total number of people living in relative poverty in the rural parts of Zhangye City decreased from 293,098 in 2001 to 72,193 in 2007, or by 75%. A total of 220,905 people have been lifted above the relative poverty line.⁷ The implementation of the community development plan by XHC and the local governments has greatly promoted local community development in Xishui Township. The plan was drawn up during project preparation and the early stages of implementation to ensure the development of local communities in harmony with traditional values and customs. The plan covered local roads, education, health, religious protection, electricity supply, water supply, telecommunications, technical training, and job opportunities.

38 The Project has provided jobs for local people, both during construction and during the operation of the plant. A total of 1,325 local laborers worked on the construction, from 2003 to 2006. In addition, XHC has so far hired around 70 people for plant O&M, all of them recruited locally in Zhangye City. The Project has also promoted equal employment opportunities for women, as well as gender development, largely because of the improvements made in transportation and communication. Before the Project, fewer people used to leave in search of work; now most young people do, and about 20%–30% of the migrants are female. Female

⁷ CNY825 in 2001 and CNY1,196 in 2007.

employees enjoy wages equal to those of male employees for similar jobs. In addition, women also actively participated in land acquisition and resettlement, particularly in the management of the compensation fund. Appendix 14 analyzes in detail the social impact, poverty reduction, and community development in the project area.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

39 The Project and the associated TA were highly relevant to the Government's development strategy and ADB's sector policy in the PRC. It was highly effective in achieving the Project's purpose and objectives, and efficient in implementation. The resettlement was successful. The environmental impact was positive, and all the necessary mitigation measures were taken. The social impact was positive and is expected to increase further in the future.

40 Through the joint efforts of the project owners (the construction companies, the supervising agents, and the financial institutions including ADB), the Project was completed and produced electricity about 6 months ahead of the appraisal schedule. Project implementation was in line with the country's rules and regulations as well as ADB's requirements and loan covenants, and the construction can be considered a successful example in the energy sector. After more than 2 years of plant operation, conditions have remained normal and no accident has occurred in the head station, water diversion tunnels, plant equipment, power transmission line, or public utilities. The actual electricity output has exceeded the design capacity. Power generation in the city has increased and a stable supply of electricity, especially to the rural areas, is guaranteed. The local industrial structure has thus been optimized, and the sustainable development of the local economy stimulated. Project implementation has greatly strengthened the institutional capacity of XHC and the managerial and operational competence of its managers and staff. The financial and economic viability of the Project has been confirmed, with enough tariff revenue to cover O&M cost, depreciation, and debt services. The expected project direct benefits have been fully realized and will be successfully maintained in the long run.

41 The Project's strong and positive environmental and developmental impact has been recognized by the Government and has prompted it to seek ADB financing for two other hydropower projects in the same cascade development scheme (footnote 1). Overall, the Project is rated highly successful (Appendix 15). It was highly relevant, highly effective, and efficient, and its benefits are most likely to be sustainable. The anticipated outputs were fully achieved, and the budget was well controlled. A project performance evaluation to review the Project's performance may be fielded in 2010.

B. Lessons

42 The successful construction of the Project resulted from the high ownership of the Project as promoted by the Government throughout the country. XHC always took the initiative in solving problems in the provision of design documents, the timely delivery of equipment, the approach to dealing with accidents, and other areas. The owner's initiative guaranteed appropriate procedures and timely action.

43 The external supervising mechanism, effectively adopted, also played an important role in improving the quality of the Project. The selection and hiring of competent international and

national consultants ensured that the quality standards required for projects with high investment costs were observed.

44 Properly administered bidding processes were vital in obtaining advantageous bid offers. Following these processes, both in equipment procurement and in site construction, enabled savings in capital cost and ensured the quality of construction and equipment supply. Deviations between the final project costs and the appraisal estimates were small.

45 **Timely Fund Availability.** For smooth project implementation, the required funds must be made available on time. In the Project, the availability of counterpart funds was a key issue, as the funds could not be secured until the project launching. ADB staff must carefully scrutinize counterpart fund arrangements and availability during project appraisal.

46 **Training.** Comprehensive training in ADB procedures and guidelines and project administration for the project management staff at the start of and during project implementation helped improve the performance of the Project.

47 **Delegation to the Resident Mission.** ADB delegated project administration to its PRC Resident Mission on 28 December 2004, resulting in more efficient communications between the EA, the IA, and ADB. The EA appreciated the contribution of good communications and efficient links between the EA, the IA, and ADB to the smooth implementation of the Project.

48 Other lessons from the Project are as follows:

- (i) **Land acquisition and resettlement.** Land acquisition and resettlement were implemented well. Besides cash compensation for grassland acquired for the Project, XHC has provided annual fodder subsidy to households that were relatively seriously affected. This is good practice and can be applied in future projects where the situation is similar. The cost of land acquisition and resettlement was not adequately budgeted because fees levied by the government were underestimated. The cost should be adequately provided for in future project budgets.
- (ii) **Social development.** The implementation of the community development plan has greatly promoted local community development and enabled the local people to share harmoniously in the benefits from the Project. Such a plan may be needed in other similar projects in the PRC; in that case it should be provided for in the project budget.
- (iii) **Environment protection and management.** Soil and water conservation measures are being implemented effectively in the project reservoir area. Five percent of XHC's tax payments to the Zhangye municipal government go into a special fund to finance the maintenance and improvement of the ecology in the reservoir area and the Qilian Mountain Nature Reserve. This effective regime of ecological management for areas with construction projects may be extended elsewhere in the PRC.

C. Recommendations

1. Project-Related

49. **Future Monitoring.** The Project has been implemented and is operating as planned. But XHC will continue to monitor and evaluate the project impact, and report its findings to ADB, through the project performance management system to ensure that the project facilities are managed effectively and that the benefits, particularly to the poor, are maximized. As agreed, XHC will collect data on the Project yearly for 3 years after its completion, update the project performance management system report, and submit the report to ADB in due course.

50. Day-to-day monitoring and inspection will be maintained at the head station, water tunnel, and powerhouse. This includes data analysis, daily maintenance, and repair. Staff will be trained regularly in safety and security procedures. For the protection and restoration of disposal sites and borrow pits, the necessary measures should be continuously taken to prevent erosion problems during the operation period. Current protection measures for permanent access roads have been adequate, but routine maintenance, particularly for drainage systems, should be ensured to minimize soil loss and potential risks due to slope collapse.

51. **Further Action or Follow-Up.** The Project requires no specific future action from ADB, as most performance targets have been met.

52. **Additional Assistance.** ADB could consider providing TA to support the Government's efforts to develop rural clean energy in Gansu in the areas of biomass, wind, and solar power.

53. **Timing of the Project Performance Evaluation Report.** All the facilities under the Project are operating normally. ADB could undertake a project performance evaluation review in 2010, after another year of operation.

2. General

54. The favorable experience with the Project demonstrates that clean and renewable energy (hydropower) can support sustainable development. ADB may consider supporting more power generation projects that are designed to minimize adverse environmental and social impact, and maximize efficiency.

PROJECT FRAMEWORK

Design Summary	Performance Indicators and Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
<p>Goal</p> <p>To promote sustainable development, economic growth without environmental degradation, and social development in Gansu Province and the project area</p>	<p>Clean energy use increases by 5.6% from 2005</p> <p>Poverty reduction in Zhangye City: gross domestic product (GDP) increases by 8% from 2005 to 2009, and by 6% from 2010 to 2014</p> <p>Per capita net annual income growth rate increases from the current 5% to 7% in 2005–2009 to 8% in 2010–2014</p> <p>Rural poverty incidence in Zhangye City declines from 27% to 20% by 2009 and 10% by 2014</p>	<p>Hydropower as a percentage of total electricity generation in the city was 97.24% in 2005, 46.17% in 2006, 34.55% in 2007, and 39.78% in 2008. The power generated by the Project accounted for 4.07% of the total generated in the city in 2006, 8.03% in 2007, and 7.73% in 2008.</p> <p>Poverty reduction in Zhangye City: GDP increased by 11.6% from 2003 to 2007</p> <p>Per capita net annual income growth rate increased to 13.4% from 2003 to 2007</p> <p>Rural poverty incidence in Zhangye City declined to 8% in 2007</p>	<p>Zhangye and Gansu statistical yearbooks</p> <p>National, provincial, and local environmental and energy reports</p> <p>Loan review missions (LRMs), midterm review, project completion report (PCR), and project performance management system (PPMS)</p> <p>Participatory rural appraisal (PRA) monitoring and evaluation</p>	<p>Macroeconomic conditions in PRC and in Gansu province are sound</p> <p>Political stability continues</p> <p>Additional power supply becomes available to balance predicted demand</p> <p>Complementary social services are in place</p>
<p>Purpose</p> <p>Increase clean energy generation; improve efficiency and reliability of supply of electric power in the project area</p>	<p>Load shedding is reduced from the current 1,975 hours per year to less than 100 hours per year by 2010</p> <p>Electricity consumption in Zhangye increases by 11.8% per year to 2005, and by 8% per year after that to 2010</p> <p>Per capita annual electricity consumption increases from current 716 kilowatt-hours (kWh) to 1,119 kWh in 2009 and 1,644 kWh in 2014 (280 kWh from the Project)</p>	<p>No more power shortage; no load shedding took place in 2006–2007</p> <p>Electricity consumption in Zhangye increased by 17% per year from 2003 to 2007</p> <p>Per capita annual electricity consumption increased to 1,719 kWh in 2007</p>	<p>Gansu Statistical Yearbook, county statistics, public data using existing method for measuring load shedding</p> <p>Zhangye electricity sales data, PRA results, PPMS, and PCR</p> <p>Consumer expenditure data at county level, Zhangye tariff schedule</p> <p>Annual reports of energy sector and user surveys</p>	<p>Strong demand for energy in Hexi corridor and Gansu continues</p> <p>Electricity tariffs are rationalized; network maintenance improves</p> <p>Good economic performance in Hexi corridor and Gansu continues</p>

Design Summary	Performance Indicators and Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
Prevent deterioration of air quality	Clean energy use increases by 5.6% from 2006	The power generated by the Project accounted for 4.07% of the city's total in 2006, 8.03% in 2007, and 7.73% in 2008.	Energy statistics	Environmental agencies continue to enforce environmental regulations and standards
	Grade II air quality standards for particulate matter, sulfur dioxide, and nitrogen oxides are maintained in the project area	Grade II air quality standards for particulate matter, sulfur dioxide, and nitrogen oxides have been maintained in the project area	Air quality monitoring	
Support poverty reduction program of Zhangye City	Rural electricity tariffs are reduced from the current range of CNY0.54–CNY1.00 per kWh to a range of CNY0.29–CNY0.5 per kWh in 2005	Rural electricity tariffs were reduced to CNY0.5 per kWh in 2005	Zhangye electricity statistics, Zhangye tariff schedule, PRA results, PPMS, and PCR	Supply cost reductions due to efficiency improvements in grid operations are passed on to consumers
	1,500 person-years of new jobs are provided to the poor in the project area in 2003–2007	1,322 person-years of new jobs were provided to the poor in the project area in 2003–2007	Consumer expenditure data at county level, annual reports of energy sector and user surveys	National Development and Reform Commission and Gansu Provincial Pricing Bureau continue to support tariff reforms in Zhangye
	Average monthly electricity consumption of poor households increases from the current 58 kWh to 137 kWh in 2005 and 219 kWh in 2009	Average monthly electricity consumption of poor households increased to 193 kWh in 2007	Zhangye health and education statistics	
Outputs				
Increased clean energy generating capacity and connection to regional power grid	Diversion weir, tunnel, and power station with two 40 megawatt (MW) units and one 18 MW unit are built by 2007	Diversion weir, tunnel, and power station with two 40 MW units and one 22 MW unit were built by 2006	Quarterly progress reports, LRMs, and PCR	High-quality equipment and proper consulting services are procured on time
	Two 19-kilometer (km) 110-kilovolt (kV) transmission lines connecting to the service substation are built by 2007	Two 19 km 110 kV transmission lines connecting to the service substation were built by 2006	Annual updates of corporate plans and financial accounts, and financial projections for Project	National Development and Reform Commission approves project construction on time
	Financial performance: around 6% return on net assets of Xiaogushan Hydropower Company (XHC) starting in 2010	Financial performance: around 10.7% average return on net assets of XHC is expected to be maintained in 2006–2018	PPMS and environmental monitoring and management plan; county and city environmental	Training courses are suitable
				There are no unexpected adverse environmental effects

Design Summary	Performance Indicators and Targets		Monitoring Mechanisms	Assumptions and Risks
	Appraisal	Actual		
Closure of old coal-fired power plants	Environmental management program is fully implemented	Environmental management program has been fully implemented	protection bureaus to monitor environmental performance	Mitigation measures are fully implemented
More reliable rural electrification network	Old generating units totaling 8.5 MW are closed by 2007	Old generating units totaling 8.5 MW were closed by 2007	Local governments' environmental monitoring report, PPMS, and PCR	Local governments can enforce environmental regulations
Institutional reforms	Service to three townships with population of 23,937 (93% of this below the provincial poverty line) improves	Service to three townships with population of 21,830 (91% of this below the provincial poverty line) has improved	Quarterly progress reports, LRMs, PPMS, and PCR	Implementation is timely and weather conditions are normal
	Rural distribution network in 23 counties is rehabilitated by 2007	Rural distribution network in 23 counties was rehabilitated by 2007	Metering records of grid operations unit	Local governments have good capacity for project management
	Management and operations systems of XHC improve	Management and operations systems of XHC have improved	Quarterly progress reports, LRM, and PCR	Appropriate tariff structure is in place to support poverty reduction targets
	Sound management system established in XHC by 2007	Sound management system was established in XHC by 2007	Recommended options for future private sector participation in XHC	Consultants are hired on time
				Competent international and national consultants are hired
				Implementing agencies exercise good project management
Activities		Inputs		
1. Civil works construction and equipment procurement (2003–2007)		ADB approval of bidding documents		
2. Land acquisition and resettlement (2001–2003)		Bidding and bid evaluation		
3. Consulting services for institutional development (2004–2007)		Awarding of contracts and ADB approval		
4. Environmental mitigation and closure of old power generation units (2004–2007)		Contract variations		
		Contract implementation		
		Preliminary survey and design		
		Acquisition of land and resettlement of affected people		
		Monitoring by Lanzhou University		
		Hiring of consultants		
		Development and implementation of training plans		
		Implementation of mitigation measures recommended in the environmental impact assessment report		
		Monitoring by Zhangye Environment Protection Agency		

km = kilometer, kV = kilovolt, LRM = loan review mission, PRA = participatory rural appraisal, PRC = People's Republic of China, PCR = project completion report, PPMS = project performance management system, XHC = Xiaogushan Hydropower Company.

CHRONOLOGY OF MAJOR EVENTS IN THE PROJECT'S HISTORY

Date	Project Events
27 September 2001	Approval of project preparatory technical assistance for Gansu Hydropower Project ^a
15–24 January 2003	ADB fact-finding mission
13 May 2003	Management review meeting; ADB approved advance procurement action; appraisal mission was waived.
20 August 2003	Staff review committee meeting
11 September 2003	ADB approved retroactive financing up to \$3.5 million.
27–30 October 2003	Loan negotiations
5 December 2003	Loan approval
23 February 2004	ADB approved award of four NCB packages for civil works of (i) numbers 1 and 2 flood discharge and sediment ejection gate, inlet construction, and gate installation; (ii) up reach for diversion tunnel in bidding section III; (iii) up reach for diversion tunnel in bidding section V; and (iv) surge shaft and high pressure channel works.
24–28 February 2004	ADB inception mission
27 April 2004	Loan signing
14 May 2004	ADB approved award of five ICB packages for turbines, gate and built-in fittings, hydraulic headstock gear for arc gate, and crane.
13 July 2004	ADB approved award of one NCB package for movable lifting decontaminator, inlet trash screen and items of embedded parts.
4 August 2004	Loan effectiveness
15 September 2004	Consultants commenced services. ADB approved award of six NCB packages for water inlet valves, governor and oil-pressure devices, and monitoring systems.
14–20 November 2004	ADB loan review mission
10 December 2004	ADB approved award of three ICB packages for cable and station service power transformer, and 10 LCB packages for power plant equipment.
23 December 2004	ADB approved award of 19 NCB packages for civil works, equipment, supervision, survey designing, and engineering designing.
28 December 2004	Transfer of project administration responsibility to ADB PRC Resident Mission
3 February 2005	ADB approved award of three NCB packages for civil works, oil system, and water supply and sewerage system.
15 March 2005	ADB approved award of four NCB packages for rural road.
24 March 2005	ADB approved award of three NCB packages for air system, cable support and heating ventilation equipment.
9 June 2005	ADB approved award of one NCB package for transmission equipment.
22 July 2005	ADB approved reallocation of loan proceeds.
26 August 2005	ADB approved award of 1 NCB package for auxiliary electrical equipment.
17–24 October 2005	ADB loan review mission
17–20 March 2006	ADB loan review mission
23 April 2006	Hinge construction completed and received inspection
30 April 2006	Completion of 110 kV transmission line
12 May 2006	Start of trial operation of first turbine (unit number 3).
18 May 2006	ADB approved award of 1 NCB package for oil.
20 June 2006	ADB approved reallocation of loan proceeds.
8 July 2006	Start of trial operation of second turbine (unit number 1)
11 July 2006	ADB approved award of 2 NCB packages for civil works of (i) road modification; and (ii) highwall slope processing.
27–31 July 2006	ADB midterm review mission
29 July 2006	Start of trial operation of third turbine (unit number 2)
9–13 July 2007	ADB loan review mission
9 November 2007	ADB approved reallocation of loan proceeds.
19 December 2007	Final disbursement of loan proceeds
30 April 2008	Original loan closing date
12 August 2008	Imprest account balance refunded to ADB.
2 September 2008	Cancellation of loan savings and effective date of loan closing
4–12 May 2009	Project completion review mission

ADB = Asian Development Bank, ICB = international competitive bidding, NCB = national competitive bidding, PRC = People's Republic of China.

^a ADB. 2001. *Technical Assistance to the People's Republic of China for Preparing the Gansu Hydropower Project*. Manila.

Source: Asian Development Bank.

PROJECT COST AND FINANCING PLAN

Table A3.1: Detailed Project Cost
(\$ million)

Component	Appraisal			Actual		
	Foreign	Local	Total	Foreign	Local	Total
A. Base Cost						
1. Civil Works	14.5	39.2	53.6	16.9	42.3	59.2
2. Power Station Equipment	12.5	0.3	12.7	9.7	3.0	12.6
3. Environment Protection and Conservation	0.6	0.0	0.6	0.0	0.7	0.7
4. 110 kV Transmission Line	2.3	0.0	2.3	1.1	1.2	2.3
5. Designing and Supervising	0.3	3.8	4.1	0.9	2.2	3.1
6. Institution Strengthening	0.7	0.0	0.7	2.2	1.8	4.0
7. Rural Electrification	0.1	0.8	0.9	0.0	1.3	1.3
8. Land, resettlement, and Others	0.0	0.0	0.0	0.0	2.5	2.5
Total Project Based Cost	30.9	44.0	74.9	30.8	54.9	85.7
B. Contingencies						
1. Physical Contingencies	0.2	1.8	2.0	0.0	0.0	0.0
2. Price Contingencies	0.0	1.1	1.1	0.0	0.0	0.0
C. Financial Charges During Development	3.9	5.2	9.0	3.2	4.4	7.7
Total Project Cost	35.0	52.0	87.0	34.0	59.3	93.4

Source: Asian Development Bank.

Table A3.2: Summary Financing Plan
(\$ million)

Source	Appraisal				Actual			
	Foreign	Local	Total	%	Foreign	Local	Total	%
A. Loans								
1. Asian Development Bank	35.0	0.0	35.0	40.2	34.0	0.0	34.0	36.5
2. Domestic Banks	0.0	38.0	38.0	43.7	0.0	40.2	40.2	43.1
Subtotal A	35.0	38.0	73.0	83.9	34.0	40.2	74.3	79.5
B. Equity Capital								
1. Heihe Hydropower Development Company	0.0	7.0	7.0	8.0	0.0	12.6	12.6	13.5
2. Zhangye Water and Power Bureau	0.0	4.2	4.2	4.8	0.0	6.5	6.5	6.9
3. Gansu Yinlong Construction Company	0.0	2.8	2.8	3.2	0.0	0.0	0.0	0.0
Subtotal B	0.0	14.0	14.0	16.1	0.0	19.1	19.1	20.5
Total	35.0	52.0	87.0	100.0	34.0	59.3	93.4	100.0

Source: Asian Development Bank.

PROJECTED AND ACTUAL CONTRACT AWARDS AND DISBURSEMENTS

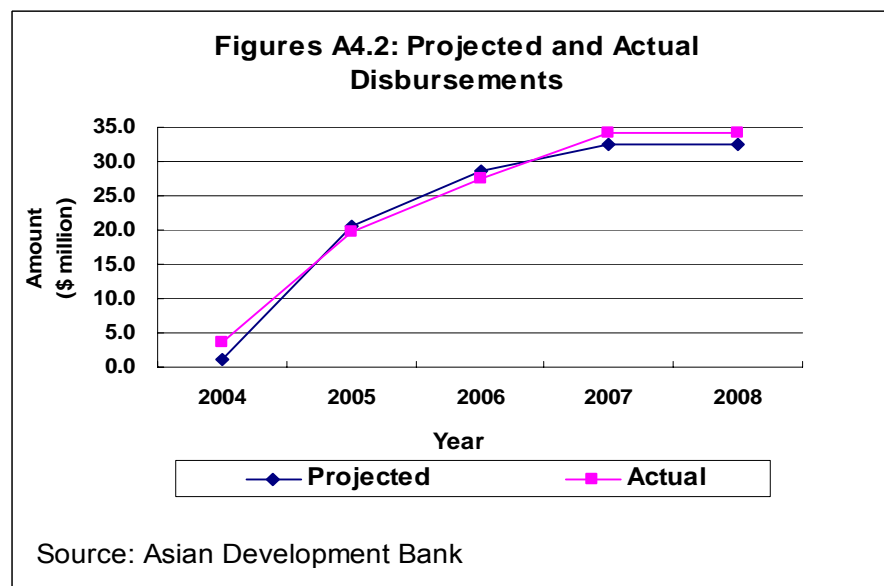
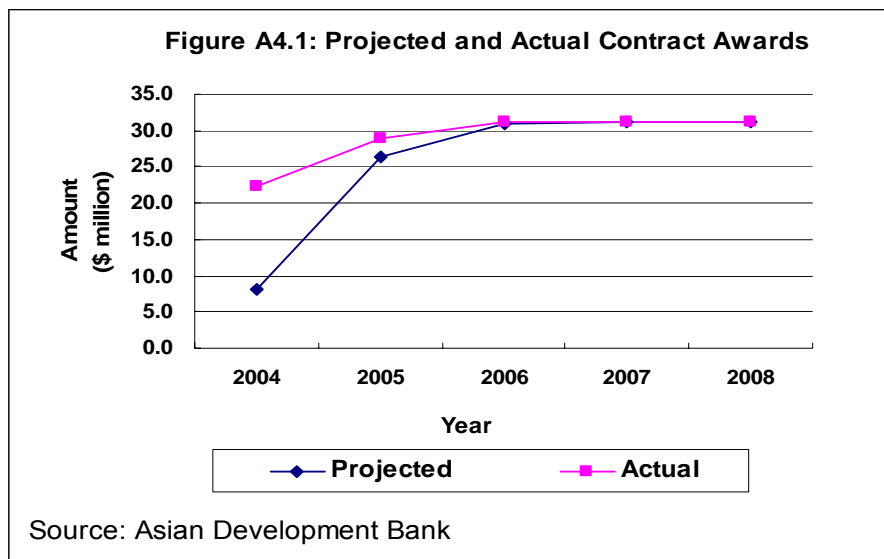
Table A4: Cumulative Contract Awards and Disbursements
(\$ million)

Year	Contract Awards		Disbursement	
	Projected ^a	Actual	Projected ^a	Actual
2004	8.0	22.4	1.2	3.5
2005	26.3	28.9	20.5	19.7
2006	30.9	31.3	28.7	27.4
2007	31.3	31.3	32.4	34.1
2008	31.3	31.3	32.4	34.0 ^b
Total	31.3	31.3	32.4	34.0

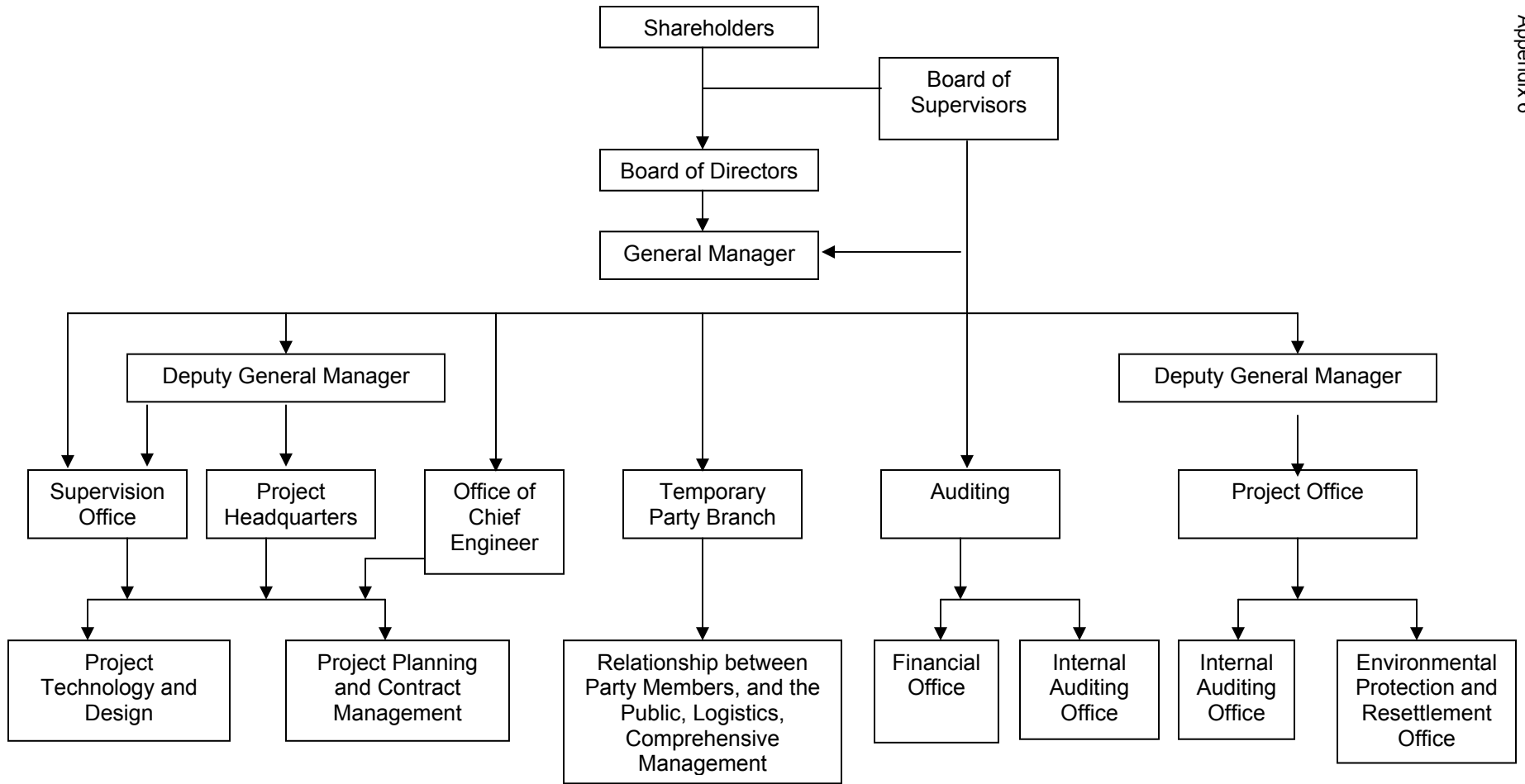
^a Annual projected plus cumulative contract awards or disbursement of previous year.

^b Refund of imprest account balance, \$0.02 million.

Source(s): Asian Development Bank



ORGANIZATION CHART



Source: Xiaogushan Hydropower Company.

STATUS OF COMPLIANCE WITH LOAN COVENANTS

Covenant	Reference in Loan and Project Agreement	Status of Compliance
General		
1. The Borrower shall, through GPG and ZCG, cause XHC to carry out the Project with due diligence and efficiency and in conformity with sound administrative, financial, engineering, environmental, hydropower, and rural electrification.	LA, Section 4.01(a); PA, Section 2.01(a)	Complied with.
2. The Borrower shall make available to GPG, and cause GPG and ZCG to make available to XHC, promptly as needed an on terms and conditions acceptable to ADB, the funds, facilities, services, land, and other resources which are required, in addition to the proceeds of the Loan, for the carrying out of the Project.	LA, Section 4.02; PA, Section 2.02	Complied with.
3. The Borrower shall ensure that the activities of its departments and agencies with respect to the carrying out of the Project and operation of the Project facilities are conducted and coordinated in accordance with sound administrative policies and procedures.	LA, Section 4.03	Complied with.
4. The Borrower shall take all action which shall be necessary on its part to enable GPG, ZCG, and XHC to perform their respective obligations under the Project Agreement, including the establishment and maintenance of tariffs as stipulated in para. 7 of the Schedule to the Project Agreement, and shall not take or permit any action which would interfere with the performance of such obligations.	LA, Section 4.04; PA, Section 2.01(b)	Complied with.
5. The Borrower shall cause ZCG to exercise its rights under the On-lending Agreement in such a manner as to protect the interest of the Borrower and ADB and to accomplish the purposes of the Loan.	LA, Section 4.05(a); PA, Section 2.07(a)	Complied with.
6. No rights or obligations under the On-lending Agreement shall be assigned, amended, abrogated, or waived without the prior concurrence of ADB.	LA, Section 4.05(b); PA, Section 2.14	Complied with.
7. In the carrying out of the Project, XHC shall employ competent and qualified consultants and contractors, acceptable to ADB, to an extent and upon terms and conditions satisfactory to ADB.	PA, Section 2.03(a)	Complied with.

Covenant	Reference in Loan and Project Agreement	Status of Compliance
8. Except as ADB may otherwise agree, all goods and services to be financed out of the proceeds of the Loan shall be procured in accordance with the provisions of Schedule 4 and Schedule 5 to the Loan Agreement.	PA, Section 2.03(b)	Complied with.
9. XHC shall carry out the Project in accordance with plans, design standards, specifications, work schedules, and construction methods acceptable to ADB.	PA, Section 2.04	Complied with.
10. XHC shall furnish to ADB quarterly reports on the execution of the Project and on the operation and management of the Project facilities.	PA, Section 2.08(b)	Complied with.
11. Promptly after physical completion of the Project, but in any event not later than three (3) months thereafter or such later date as ADB may agree for this purpose, XHC shall prepare and furnish to ADB a report, in such form and in such detail as ADB shall reasonably request, on the execution and initial operation of the Project, including its cost, the performance by XHC of their respective obligations under this Project Agreement, and the accomplishment of the purposes of the Loan.	PA, Section 2.08(c)	Complied with.
12. XHC shall (i) maintain separate accounts for the Project and for its overall operations; (ii) have such accounts and related financial statements (balance sheet, statement of income and expenses, and related statements) audited annually, in accordance with appropriate auditing standards consistently applied, by external auditors whose qualifications, experience, and terms of reference are acceptable to ADB; and (iii) furnish to the Bank promptly but not later than nine months after the close of the fiscal year to which they relate, certified copies of audited accounts and financial statements and report of the auditors relating thereto (including the auditor's opinion on the use of the Loan proceeds and compliance with the covenants of the Loan Agreement as well as on the use of the procedures for statement of expenditure), all in the English language. XHC shall furnish to	PA, Section 2.09(a)	(i) Complied with. (ii) Complied with. (iii) Complied with.

Covenant	Reference in Loan and Project Agreement	Status of Compliance
<p>ADB such further information concerning such accounts, and financial statements and the audit thereof as ADB shall from time to time reasonably request.</p>		
<p>13. XHC shall enable ADB, upon ADB's request, to discuss XHC's financial statements and financial affairs from time to time with XHC's auditors, and shall authorize and require any representative of such auditors to participate in any such discussions requested by ADB, provided that any such discussion shall be conducted only in the presence of an authorized officer of XHC unless XHC shall otherwise agree.</p>	PA, Section 2.09(b)	Complied with.
<p>14. XHC shall, promptly as required, take all action within its powers to maintain its corporate existence, to carry on its operations, and to acquire, maintain, and renew all rights, properties, powers, privileges, and franchises which are necessary in the carrying out of the Project or in the conduct of its business.</p>	PA, Section 2.11(a)	Complied with.
<p>15. XHC shall at all times conduct its business in accordance with sound administrative, financial, environmental, hydropower, and rural electrification practices, and under the supervision of competent and experienced management and personnel.</p>	PA, Section 2.11(b)	Complied with.
<p>16. XHC shall at all times operate and maintain its plants, equipment, and other property, and from time to time, promptly as needed, make all necessary repairs and renewals thereof, all in accordance with sound administrative, financial, engineering, environmental hydropower, rural electrification, and maintenance and operational practices.</p>	PA, Section 2.11(c)	Complied with.
<p>17. Except as ADB may otherwise agree, XHC shall not sell, lease, or otherwise dispose of any of its assets which shall be required for the efficient carrying on of its operations or the disposal of which may prejudice its ability to perform satisfactorily any of its obligations under this Project Agreement.</p>	PA, Section 2.12	Complied with.

Covenant	Reference in Loan and Project Agreement	Status of Compliance
Environment		
18. XHC shall ensure that the design, construction, and operation of all Project facilities comply with the environmental laws and regulations and procedures of the Borrower and the local government and ADB's guidelines and procedures on environment.	PA, Schedule, para. 14	Complied with.
19. XHC shall ensure that any adverse environmental impacts arising from the construction and operation of the Project facilities will be minimized by implementing the mitigation measures, monitoring program, and other recommendations in the EIA.	PA, Schedule, para. 15	Complied with.
20. XHC shall submit to ADB a comprehensive environmental status on a bi-annual basis starting from June 2004 to the completion of the Project implementation, including (i) progress made on the mitigation measures, (ii) monitoring data, (iii) problems encountered, (iv) enforcement plan, and (v) if being cited as violating any safety or environmental standards, or any laws and regulations of the Borrower or the local government, confirmation from the relevant agency of the Borrower or the local government showing that the violation has been corrected or a plan to correct the violation has been accepted.	PA, Schedule, para. 16	Complied with.
21. GPG shall cause ZEPC to complete the closure of one coal-fired power plant with a total capacity of 8.5 MW in the North West Power Grid by 31 December 2007 in accordance with the Borrower's environmental and safety standards. GPG shall cause ZEPC to ensure that the workers at the power plant will be redeployed in a manner consistent with the policy and relevant law on labor and social security protection of the Borrower and ADB's Social Protection Strategy.	PA, Schedule, para. 19	Complied with.
Economics		
22. GPG and ZCG will cause ZEPC and XHC to implement the power sector and tariff reform program of the Government and tariff reduction programs including a lifeline tariff for poor consumers as agreed upon with ADB.	PA, Schedule, para. 6	Complied with.

Covenant	Reference in Loan and Project Agreement	Status of Compliance
<p>23. GPG and ZCG shall be responsible for formulating tariff of the electricity generated by XHP will be adequate for XHC to cover operating costs, maintenance and depreciation, financing cost, and from fiscal year 2009, allow an acceptable return on the net fixed assets.</p>	PA, Schedule, para. 7	Complied with.
<p>Financial</p> <p>24. ZCG and XHC shall ensure that on a timely basis all funds and resources necessary for construction of the Project Power Plant and other facilities under the Project be provided in accordance with the financing plan for the Project as agreed by ADB.</p>	PA, Schedule, para. 3	Complied with.
<p>25. XHC shall not incur any debt unless a reasonable forecast of the revenues and expenditures of XHC shows that the estimated net revenues of XHC for each fiscal year shall be, (i) commencing from the fiscal year 2008, at least 1.2 times, and (ii) commencing from the fiscal year 2010, at least 1.3 times, the estimated debt service requirements of XHC in such year on all debt of XHC including the debt to be incurred.</p>	PA, Schedule, para. 10	Being complied with.
<p>26. XHC shall maintain for each year, (i) commencing from the fiscal year 2008, a ratio of debt to equity not greater than 75:25; and (ii) commencing from 2010, a ratio of debt to equity not greater than 65:35.</p>	PA, Schedule, para. 11	Being complied with.
<p>Sector</p> <p>27. XHC shall construct a 35 kV transmission line from Longqu hydropower plant to the Project Power Plant. ZCG shall construct another 35 kV transmission line to transmit electricity from the Project Power Plant to Baojiwan through Xishui, Huazhai, and Anyang townships. During the operation of the Project Power Plant, XHC shall supply power to these three townships at the average or a lower than average of the prevailing market price of power.</p>	PA, Schedule, para. 26	Complied with.

Covenant	Reference in Loan and Project Agreement	Status of Compliance
<p>Social</p> <p>28. GPG, ZCG, and XHC shall ensure that all land and rights-of-way required for the Project be made available in a timely manner and that the Resettlement Plan agreed upon with ADB be carried out promptly and efficiently in line with ADB's Policy on Involuntary Resettlement.</p> <p>29. ZCG shall implement the community development strategy and plan dated April 2003 for Xishui Township which has been endorsed by ADB during the Project implementation period and keep ADB updated of any changes and progress of implementation.</p> <p>30. With the assistance of the relevant local authorities, GPG, through ZCG, and XHC shall cause contractors to distribute information on the risks of sexually transmitted diseases to those employed during Project construction and to the local communities in Xishui Township.</p> <p>31. XHC shall ensure that (i) there is no differential payment between men and women for work of equal value, and (ii) civil works contractors do not employ child labor in the construction and maintenance activities in accordance with the relevant laws and regulations of the Borrower.</p> <p>32. XHC, in consultation with Heihe Hydropower Development Company (HHDC), shall prepare a human resource development plan. Before undertaking international training, XHC shall prepare, for ADB's concurrence, (i) a training plan and number of trainees, (ii) a program of workshops to be delivered by those trained internationally, and (iii) a list of training equipment and aids required to strengthen XHC's and HHDC's training programs. Upon completion, XHC shall submit to ADB an evaluation of international and domestic training.</p>	<p>PA, Schedule, para. 17</p> <p>PA, Schedule, para. 18</p> <p>PA, Schedule, para. 22</p> <p>PA, Schedule, para. 23</p> <p>PA, Schedule, para. 25</p>	<p>Complied with.</p> <p>Complied with.</p> <p>Complied with.</p> <p>Complied with.</p> <p>Complied with.</p>
<p>Others</p> <p>33. GPG and ZCG shall ensure that additional transmission lines to the existing Zhangye city 330/110 kV substation and expansion of that substation shall be completed in a</p>	<p>PA, Schedule, para. 5</p>	<p>Complied with.</p>

Covenant	Reference in Loan and Project Agreement	Status of Compliance
timely manner to accommodate additional power delivery from the Project Power Plant.		
34. A mid-term review shall be carried out in 2006. During the mid-term review, XHC shall, among others, submit to ADB for its review, financial projections for the next five years. Thereafter, XHC shall update the financial projections annually.	PA, Schedule, para. 12	Complied with.
35. GPG, through ZCG, and XHC shall monitor, evaluate, and report to ADB the Project impacts through PPMS to ensure that the Project facilities are managed effectively and benefits particularly to the poor, are maximized. GPG, through ZCG, and XHC shall collect data agreed with ADB prior to Project implementation, project completion, and annually for three years after the Project completion.	PA, Schedule, para. 21	Being complied with.
36. In accordance with the Company Law of the Borrower, XHC shall convene a general meeting of shareholders once a year within 6 months after the completion of the previous accounting year and convene a temporary general meeting of the shareholders to discuss and decide on the matters in accordance with its Articles of Association.	PA, Schedule, para. 27	Complied with.
37. XHC shall ensure that its Supervisory Board be formed in accordance with the Borrower's Company Law, comprising representatives of shareholders and including an appropriate proportion of representatives of the staff and workers of XHC, and ensure that the members of the Board of Directors, managers, and chief financial officer of XHC shall not serve on the Supervisory Board.	PA, Schedule, para. 28	Complied with.
38. XHC shall ensure that (i) a minimum of 30% of its Board of Directors represent finance and energy industries in order to benefit from the knowledge and experiences of cross regional and cross industrial board members; (ii) the independent board members be free from any business or other relationship with XHC that can adversely affect their independent judgment, such as from any provincial or national finance bureaus.	PA, Schedule, para. 28	(i) Complied with. (ii) Being complied with.

Covenant	Reference in Loan and Project Agreement	Status of Compliance
39. XHC shall constitute an Audit Committee within its Board of Directors. XHC shall ensure that (i) the Audit Committee comprise a chairperson and two other non-executive members, each of whom will be appointed by XHC's Board of Directors; (ii) the Chairperson of its Board of Directors will not be Chairperson of the Audit Committee; (iii) the majority of the Audit Committee will consist of the independent directors; and (iv) the head of internal audit department will be required to attend and report to the Audit Committee.	PA, Schedule, para. 31	Complied with.

ADB = Asian Development Bank, GPG = Gansu provincial government, HHDC = Heihe Hydropower Development Company, PRC = People's Republic of China, XHC = Xiaogushan Hydropower Company, ZCG = Zhangye city government, ZEPC = Zhangye Electric Power Company.

Source(s): Asian Development Bank.

SUMMARY OF CONTRACT PACKAGES

PCSS No.	Item	Mode of Procurement	Date of Contract	Name of Contractor	Currency	Original Contract Amount	Final Contract Amount	ADB Financing Amount (\$)
0001	Diversion Tunnel (pkg 1.2.4)	NCB	20-Mar-04	No. 13 China Railway Engineering Group	CNY	20,702,296.0	27,498,214.0	1,735,806.0
0002	Diversion Tunnel (pkg 1.2.5)	NCB	20-Mar-04	No. 3 Engineering of Engineering Bureau Group	CNY	18,118,866.0	19,416,587.3	1,201,869.4
0003	Diversion Tunnel (pkg 1.2.6)	NCB	20-Mar-04	No. 1 Engineering of Railway Engineering Bureau Group	CNY	12,932,062.0	12,198,142.1	759,179.0
0004	Surge Shaft and High Pressure Channel Works	NCB	20-Mar-04	China Water and Hydropower No. 1 Engineering Bureau	CNY	19,680,000.0	24,605,605.9	1,557,839.6
0005	Movable Lifting Decontaminator, Inlet Trash Screen, and Items of Embedded Parts	NCB	05-Aug-04	China Machinery Company for Foreign Technical Cooperation	CNY	1,829,469.0	1,829,469.0	228,886.7
0006	40 MW Hydraulic Turbine Generator	ICB	06-Aug-04	Lanzhou Electric Import and Export Company	CNY	17,327,243.0	17,327,243.0	2,149,982.0
0007	18 MW Hydraulic Turbin Generator	ICB	06-Aug-04	Lanzhou Electric Import and Export Company	CNY	5,580,952.0	5,580,952.0	703,047.4
0008	Sluice Gate and Built-In Fittings	ICB	25-Aug-04	Liujixia Water Power Engineering under No. 4 Water Conservancy and Hydroelectricity Bureau	CNY	8,581,495.0	8,581,495.0	1,071,755.5
0009	Hydraulic Headstock Gear for Arc Gate	ICB	06-Aug-04	Changzhou Hydraulic Equipment Assembly Corporation	CNY	4,501,109.2	4,501,109.2	553,275.6
0010	Crane	ICB	06-Aug-04	Xinxiang Hoisting Equipment Factory	CNY	3,609,800.0	3,609,800.0	445,452.6
0011	Consulting Services	ICB	02-Sep-04	GHD	\$	367,800.0	367,800.0	367,800.0
0012	Computer Monitoring System	NCB	24-Nov-04	Nanjing Nari Group	CNY	2,156,169.0	2,156,169.0	267,327.8
0013	Computer Security System	NCB	01-Dec-04	Guodian Nanjing Automation	CNY	810,155.0	810,155.0	101,440.6

PCSS No.	Item	Mode of Procurement	Date of Contract	Name of Contractor	Currency	Original Contract Amount	Final Contract Amount	ADB Financing Amount (\$)
0014	Governor and Oil-Pressure Devices	NCB	25-Nov-04	Beijing IWHR Automation Engineering	CNY	951,492.3	951,492.3	118,188.0
0015	Butterfly Valve and Its Ancillary Equipment	NCB	24-Nov-04	Watts Valve (Changsha)	CNY	2,967,809.0	2,967,809.0	367,114.0
0016	Computer Monitoring System for Ancillary Equipment	NCB	24-Nov-04	Nanjing Nari Group	CNY	633,355.0	633,355.0	78,321.1
0017	Monitoring System (Including Industrial) on Hinge Hoist	NCB	26-Nov-04	Xi'an Heng Xin Hydropower Science and Technology	CNY	1,094,557.0	1,094,557.0	137,571.2
0018	No. 1 and No. 2 Spillway Gate, Inlet and Gate Erection Construction	NCB	01-Apr-04	No. 6 Engineering Gezhou Dam Group	CNY	20,516,921.0	22,408,326.1	1,279,314.7
0019	No. 3 and No. 4 Spillway Gate, Auxiliary Dam, Middle Guide Wall and Erection of the Sluice Gate	NCB	08-Jun-04	No. 6 Engineering Gezhou Dam Group	CNY	19,386,766.0	19,472,597.4	1,188,681.8
0020	Diversion Tunnel 850 m at upper reaches of Main Tunnel in No. 2 Support Tunnel	NCB	06-Aug-04	No. 13 China Railway Engineering Bureau	CNY	8,322,005.3	13,105,142.2	835,752.2
0021	Diversion Tunnel 300 m at upper reaches of Main Tunnel in No. 3 Support Tunnel	NCB	06-Aug-04	No. 3 Engineering of No. 15 China Railway Bureau Group	CNY	15,768,168.0	15,768,168.0	972,400.2
0022	Diversion Tunnel 850 m at upper reaches of Main Tunnel in No. 5 Support Tunnel	NCB	06-Aug-04	No. 1 Engineering of No. 18 China Railway Bureau Group	CNY	10,825,809.0	9,680,087.0	611,553.2
0023	Main tunnel (Ancillary Powerhouse, Erection Chamber)	NCB	06-Aug-04	No. 1 China Hydraulic and Hydroelectric Engineering Bureau	CNY	18,900,000.0	17,207,654.5	1,067,135.8
0024	Access tunnel to Powerhouse	NCB	10-Aug-04	No. 6 Engineering of Gezhou Dam Group	CNY	4,205,609.0	2,391,858.0	146,293.0

PCSS No.	Item	Mode of Procurement	Date of Contract	Name of Contractor	Currency	Original Contract Amount	Final Contract Amount	ADB Financing Amount (\$)
0025	No. 1 Implementation Support Tunnel	NCB	10-Aug-04	No. 1 Engineering of No. 18 China Railway Bureau Group	CNY	4,397,866.0	4,397,866.0	268,952.6
0026	No. 3 Implementation Support Tunnel	NCB	10-Aug-04	No. 3 Engineering of No. 15 China Railway Bureau Group	CNY	1,082,211.0	1,082,211.0	65,431.8
0027	No. 5 Implementation Support Tunnel	NCB	10-Aug-04	No. 13 China Railway Bureau Group	CNY	1,121,938.0	1,121,938.0	61,324.6
0028	Gate Foundation	NCB	10-Aug-04	China Hydraulic and Hydroelectric Engineering Bureau	CNY	16,744,118.0	12,954,524.2	783,224.2
0029	Permanent Access Road from Plant to Hinge	NCB	10-Aug-04	Zhangye Sanfeng Mechanization Engineering	CNY	19,090,000.0	19,090,000.0	1,174,279.7
0030	35 kV Transmission Line Erection	NCB	10-Aug-04	Zhangye Mechanization Installation	CNY	4,870,000.0	4,870,000.0	297,806.2
0031	Surge Tank and High Pressure Aqueduct Construction Supervision	NCB	12-Aug-04	Yellow River Engineering Consulting Company	CNY	1,667,000.0	3,344,076.3	430,086.9
0032	Hydropower Station Headrace and Diversion Tunnel Construction Supervision	NCB	10-Aug-04	China Northwest Water Conservancy and Hydropower Engineering Consulting Company	CNY	2,578,863.5	3,559,595.9	448,321.9
0033	Survey Design	NCB	08-Aug-04	No. 1 Branch of Gansu Province Hydraulic and Hydroelectric Survey and Design Institute	CNY	7,730,000.0	7,730,000.0	967,092.7
0034	Engineering Design	NCB	10-Aug-04	Gansu Province Hydraulic and Hydroelectric Survey and Design Institute	CNY	7,150,000.0	7,150,000.0	882,090.8
0035	Air and Cable Tunnel Access for Powerhouse	NCB	10-Aug-04	Gansu Hydroelectric Construction Engineering	CNY	1,930,000.0	1,330,458.2	81,620.5
0036	Ventilation Tunnel for Surge Tank	NCB	10-Aug-04	Fujian Province Haitian Construction Engineering	CNY	1,592,350.2	1,494,264.3	61,255.7
0037	110 kV Transmission Line Installation	NCB	08-Jan-05	Tianshui Yuxin Power Engineering	CNY	8,483,522.0	8,483,522.0	1,046,365.7

PCSS No.	Item	Mode of Procurement	Date of Contract	Name of Contractor	Currency	Original Contract Amount	Final Contract Amount	ADB Financing Amount (\$)
0038	OPGW Fiber Cable and Armor Clamp Installation	NCB	08-Jan-05	Tianshui Yuxin Power Engineering	CNY	547,683.0	547,683.0	67,885.1
0039	Excitation Equipment	NCB	08-Jan-05	Shanghai Power Equipment Research Institute	CNY	1,096,411.0	1,096,411.0	137,895.4
0040	High Voltage Equipment	NCB	10-Jan-05	Henan Pinggao Electric	CNY	2,028,686.0	2,028,686.0	253,552.7
0041	High and Low Voltage Switch Cabinet	NCB	08-Jan-05	Guangzhou Baiyun Electric Equipment	CNY	1,678,799.0	1,678,799.0	207,832.6
0042	Service Power System (Low Voltage Switchgear)	NCB	06-Jan-05	Danyang Suyuan Switchgear	CNY	1,012,396.0	1,012,396.0	127,287.6
0043	Direct Current System	NCB	08-Jan-05	Shanghai Qingchen Power	CNY	933,280.0	933,280.0	114,748.8
0044	Service Transformer	ICB	08-Jan-05	Beijing CCECC International Trading	CNY	1,031,097.7	1,031,097.7	126,746.9
0045	Access Road	NCB	15-Mar-05	Qinghai Xinning Ningda Construction	CNY	758,000.0	758,000.0	42,380.6
0046	Access Road	NCB	18-Mar-05	Zhangye Sanfeng Mechanization Engineering	CNY	722,372.0	722,372.0	40,245.6
0047	Access Road	NCB	18-Mar-05	Zhangye Henye Construction	CNY	628,000.0	628,000.0	35,317.9
0048	Access Road	NCB	18-Mar-05	Zhangye Longteng Mechanization Engineering	CNY	750,109.6	750,109.6	42,185.2
0049	Oil System	NCB	21-Mar-05	Zigong Fine Filter Manufacturing	CNY	260,445.0	260,445.0	32,589.9
0050	Water Supply and Sewerage System	NCB	21-Mar-05	Institute of Research Hi-technology of Sichuan University	CNY	2,687,500.0	2,687,500.0	170,796.4
0051	Fire Control System	NCB	08-Jan-05	Henan Yuchuan Firefighting Technique	CNY	438,711.4	438,711.4	55,433.1
0052	Cable	ICB	09-Jan-05	Anhui Tiankang Group	CNY	4,963,173.0	4,963,173.0	616,882.0
0053	Main Transformer	ICB	09-Jan-05	Xi'an Electric Engineering	CNY	5,979,521.0	5,979,521.0	738,406.5
0054	Air Compression System	NCB	28-Apr-05	Xi'an Shengjia Science and Technology Development	CNY	350,255.0	350,255.0	44,007.1

PCSS No.	Item	Mode of Procurement	Date of Contract	Name of Contractor	Currency	Original Contract Amount	Final Contract Amount	ADB Financing Amount (\$)
0055	Cable Bridge	NCB	28-Apr-05	Shangdong Jingguang FRP Group	CNY	2,035,075.0	2,035,075.0	256,763.2
0056	Heating and Ventilation Equipment	NCB	28-Apr-05	Shangdong Geruide Group	CNY	1,327,539.4	1,327,539.4	165,650.7
0057	Main Tailrace Gate Chamber, Tailrace Channel, Bus Bar Tunnel of Underground Powerhouse, Electromechanical Equipment Erection Engineering	NCB	06-Mar-05	China Hydraulic and Hydroelectric No. 1 Engineering Bureau	CNY	34,837,323.0	29,491,984.8	1,856,950.1
0058	Communication Equipment	NCB	18-May-05	Gansu Dian Tong Information System	CNY	868,804.9	868,804.9	109,666.4
0059	Bus Bar	NCB	28-Mar-05	Juche Group	CNY	1,244,406.8	1,244,406.8	155,115.3
0060	Auxiliary Electrical Equipment	NCB	08-Dec-05	Xi'an Sifang EM	CNY	751,929.0	751,929.0	94,463.9
0061	Oil	NCB	30-Apr-06	Petrochina Company Limited Sale Corporation, Gansu-Zhangye Branch	CNY	291,000.0	291,000.0	37,846.5
0062	Road Modification Engineering ^a	NCB	29-Jun-06	Zhangye Sanfeng Mechanization Engineering	CNY	14,551,433.9	14,551,433.9	-
0063	Highwall Slope Processing Engineering	NCB	01-Jul-06	Gansu Hydroelectric Construction Engineering	CNY	16,036,418.4	13,654,012.2	773,292.0

CNY = Chinese Yuan, ICB = international competitive bidding, NCB = national competitive bidding.

^a The contract was locally financed.

Source: Asian Development Bank.

FINANCIAL REEVALUATION

A. Basic Assumptions

1. The financial internal rate of return (FIRR) was reevaluated on the basis of financial and operational information obtained from Xiaogushan Hydropower Company (XHC) and certain revenue and cost assumptions. Capital cost is based on actual expenditures incurred for the Project, excluding interest and other financial charges during construction. The calculation period covers the construction period and 20 years of operation period. No major equipment replacement or infrastructure rehabilitation is anticipated during the calculation period. The residual value of the Project is assumed to be 20% of the capital cost. All revenues and expenses are expressed in constant 2008 prices for FIRR calculation.

2. The Xiaogushan hydropower plant (XHP) started operating in 2006 with an installed capacity of 102 megawatts (MW). The XHP generated 481.26 gigawatts (GWh) of electricity in 2007 and 439.6 GWh in 2008—thanks to the abnormally affluent water flow in the river where the hydropower plant was constructed. For projection purposes, annual operation time of 3,882 hours and annual power generation of 396 million kilowatt-hours (kWh) are assumed. The Gansu Provincial Price Bureau approved a tariff rate of CNY0.2478 per kWh for XHC, higher than the provincial benchmark tariff rate for hydropower plants set at CNY0.227 per kWh. The tariff will be reviewed every 3–5 years following the principle of ensuring full cost recovery and loan repayment, as well as a reasonable rate of return of investment. In the reevaluation, the tariff is assumed to remain constant in real terms in view of its general adequacy for full cost recovery. In addition to the revenues from power generation, XHP realizes revenues from the sale of certified emission reductions (CERs) at \$4.5 per ton of carbon dioxide. The annual revenue from CER sales amounts to about CNY12.3 million for 2006–2015. Operation and maintenance (O&M) costs are based on the actual figures of XHP and are assumed to remain constant in real terms.

3. Sales-related taxes include value-added tax of 17% on sales and city construction tax (1%) and education tax (3%). The income tax rate for XHC is 7.5% for the 3 years during 2008–2010 and 25% thereafter.

B. Financial Internal Rate of Return

4. FIRR after tax was recalculated as 8.7% without CER revenues and 10.0% with CER revenues (Table A9.1), compared with the FIRR of 7.5% estimated at appraisal. The higher FIRR is mainly attributed to the higher generation capacity even though the actual tariff is slightly lower than the appraisal estimate.

5. The after-tax weighted average cost of capital (WACC) is based on the actual capital mix and cost of various sources of financing. The London interbank offered rate (LIBOR) 10-year fixed swap rate, plus a spread of 0.6% for the ADB loan, actual interest rate of 5.98% for the domestic loan, and 12% for cost of equity investment, is used in the calculation. The WACC is recalculated as 3.1%. The Project's FIRR is higher than the WACC and the Project is therefore considered financially viable.

6. Sensitivity analysis indicates that the Project will remain viable even with a 20% decrease in revenue or a 20% increase in O&M costs, or a combination of such adverse conditions.

Table A9.1: Financial Internal Rate of Return
(CNY million)

Year	Costs			Net Revenues			Income Tax	Net Cash Flow
	Capital	O&M	Total	Energy Sales	CERs	Total		
2002	14.61		14.61					(14.61)
2003	64.25		64.25					(64.25)
2004	168.41		168.41					(168.41)
2005	218.49		218.49					(218.49)
2006	106.82	5.43	112.25	47.44	4.01	51.46		(60.80)
2007	30.80	10.92	41.72	99.47	13.72	113.19		71.47
2008	8.16	10.23	18.39	91.29	12.30	103.59	5.08	80.13
2009		8.97	8.97	81.46	12.30	93.76	4.43	80.36
2010		9.06	9.06	81.46	12.30	93.76	4.43	80.28
2011		9.19	9.19	81.46	12.30	93.76	14.72	69.85
2012		9.38	9.38	81.46	12.30	93.76	14.68	69.71
2013		9.57	9.57	81.46	12.30	93.76	14.63	69.57
2014		9.57	9.57	81.46	12.30	93.76	14.63	69.57
2015		9.57	9.57	81.46	12.30	93.76	14.63	69.57
2016		9.57	9.57	81.46		81.46	11.56	60.34
2017		9.57	9.57	81.46		81.46	11.56	60.34
2018		9.57	9.57	81.46		81.46	11.56	60.34
2019		9.57	9.57	81.46		81.46	11.56	60.34
2020		9.57	9.57	81.46		81.46	11.56	60.34
2021		9.57	9.57	81.46		81.46	11.56	60.34
2022		9.57	9.57	81.46		81.46	11.56	60.34
2023		9.57	9.57	81.46		81.46	11.56	60.34
2024		9.57	9.57	81.46		81.46	11.56	60.34
2025	(183.00)	9.57	(173.43)	81.46		81.46	11.56	243.34

FIRR with CERs: 10.0%
FIRR without CERs: 8.7%

() = negative, CER = certified emission reduction, FIRR = financial internal rate of return, O&M = operation and maintenance.
Source: ADB estimates.

Table A9.2: Sensitivity Analysis
(%)

Case	FIRR with CERs	FIRR without CERs
Base Case	10.0	8.7
(i) Energy sales reduced by 20%	7.5	6.2
(ii) Operation and maintenance cost increased by 20%	9.0	7.7
(iii) Combination of (i) and (ii)	6.3	5.0

CER = certified emission reduction, FIRR = financial internal rate of return.

Source: ADB estimates.

C. Financial Performance of Xiaogushan Hydropower Company

7. XHC was established in 2001 to construct and operate the Xiaogushan hydropower plant as the implementing agency. XHC is a joint-stock company set up in accordance with the Company Law of the People's Republic of China by two shareholders—Heihe Hydropower

Cash Flow Statements	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Increase in Working Capital	25.77	1.08	60.76	5.18	0.74	1.14	1.56	1.59	-0.05	-0.06	-0.06	-0.06	-0.06
Interests Paid	0.00	43.94	39.38	23.73	22.46	21.16	19.65	17.98	16.28	14.54	12.75	10.92	9.04
Dividend Paid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan Principal Repayment	0.00	16.80	21.19	22.81	23.50	27.19	29.96	30.82	31.71	32.68	33.74	34.85	36.31
Total Applications of Funds	25.77	63.46	121.99	51.72	46.70	49.50	51.17	50.40	47.94	47.16	46.43	45.71	45.29
Net Cash Flow	20.57	39.13	-32.81	30.67	36.01	26.69	25.53	26.77	28.55	28.64	19.43	19.42	19.09
Cash Balance Beginning	0.00	20.57	59.70	26.89	57.56	93.57	120.27	145.79	172.56	201.12	229.76	249.18	268.60
Cash Balance Ending	20.57	59.70	26.89	57.56	93.57	120.27	145.79	172.56	201.12	229.76	249.18	268.60	287.69
Balance Sheet	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cash	20.56	59.69	24.48	55.16	91.17	117.87	143.39	170.16	198.71	227.36	246.78	266.20	285.29
Accounts Receivable	26.83	29.16	87.51	78.71	79.50	80.69	82.31	83.95	83.95	83.95	83.95	83.95	83.95
Inventories	0.22	0.47	1.64	1.48	1.49	1.52	1.55	1.58	1.58	1.58	1.58	1.58	1.58
Total Current Assets	47.62	89.32	113.63	135.35	172.16	200.07	227.24	255.69	284.24	312.88	332.31	351.73	370.82
Intangible Assets	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction in Progress	52.52	66.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Fixed Assets	575.34	581.30	652.88	652.88	652.88	652.88	652.88	652.88	652.88	652.88	652.88	652.88	652.88
Net Fixed Assets	561.75	543.98	591.90	567.60	543.30	519.01	494.71	470.41	446.12	421.82	397.52	373.23	348.93
Total Assets	666.31	699.34	705.54	702.95	715.47	719.08	721.95	726.10	730.36	734.70	729.83	724.95	719.74
Total Current Liabilities	46.29	65.65	19.71	5.57	5.63	5.70	5.78	5.87	5.93	5.98	6.04	6.10	6.16
ADB Loan	0.00	211.85	228.67	224.07	218.97	213.38	207.22	200.40	192.89	184.61	175.47	165.42	154.31
Domestic Long-term Loan	0.00	263.20	246.20	228.00	209.60	188.00	164.20	140.20	116.00	91.60	67.00	42.20	17.00
Total Long Term Liabilities	487.88	475.05	474.87	452.07	428.57	401.38	371.42	340.60	308.89	276.21	242.47	207.62	171.31
Paid-in Capital	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
Retained earnings	2.14	28.64	80.95	115.32	151.27	182.00	214.75	249.64	285.55	322.51	351.32	381.23	412.27
Total Equity	132.14	158.64	210.95	245.32	281.27	312.00	344.75	379.64	415.55	452.51	481.32	511.23	542.27
Total Equity and Liabilities	666.31	699.34	705.54	702.95	715.47	719.08	721.95	726.10	730.36	734.70	729.83	724.95	719.74
Financial Indicators:													
Return on Net Fixed Assets	12.2%	14.2%	11.4%	10.0%	10.5%	9.8%	10.3%	11.0%	11.4%	11.9%	10.1%	10.6%	11.1%
Debt Ratio	73.2%	67.9%	67.3%	64.3%	59.9%	55.8%	51.4%	46.9%	42.3%	37.6%	33.2%	28.6%	23.8%
Return on Equity	15.5%	29.9%	24.3%	14.0%	12.8%	9.8%	9.5%	9.2%	8.6%	8.2%	6.0%	5.9%	5.7%
Debt Service Coverage Ratio	-	1.69	1.47	1.77	1.80	1.58	1.55	1.58	1.59	1.61	1.42	1.42	1.42
Operating Ratio	0.36	35.1%	37.8%	40.8%	40.9%	40.8%	40.6%	40.4%	40.8%	41.2%	41.6%	42.0%	42.4%

Sources: Xiaogushan Hydropower Company for 2006-2008 financial statements, projections for 2009-2018 are ADB estimates.

CER: Certified Emission Reduction

ECONOMIC REEVALUATION

A. Scope and Methodology

1. The economic reevaluation recalculates the economic internal rate of return (EIRR) of the Gansu Clean Energy Development Project and compares the results with the appraisal estimates. Project costs and benefits were reassessed on the basis of information provided by Xiaogushan Hydropower Company. The economic costs and benefits were valued using the domestic price numeraire and expressed in constant 2008 prices. The financial costs of traded goods were adjusted to their respective economic values using a shadow exchange rate factor of 1.01. The shadow wage rate for unskilled labor was estimated at 0.80 of the prevailing wage rate, and the conversion factors for skilled labor, other costs, and benefits were estimated to be 1.0. The EIRR was compared with the economic opportunity cost of capital, which is assumed to be 12%. Sensitivity analysis was undertaken to assess the robustness of the EIRR calculation.

B. Costs

2. The project costs consist of capital and operation and maintenance (O&M) costs. The actual capital costs were converted to economic values through the deduction of taxes and duties, interest, and financial charges, and the application of relevant conversion factors. Actual O&M costs for Xiaogushan hydropower plant in the past years were applied and were assumed to remain constant in real terms during the evaluation period. No major equipment replacement or infrastructure rehabilitation is anticipated.

C. Benefits

3. As envisaged at appraisal, the main benefit of the Project is power generation to meet the electricity demand in Zhangye City. The estimate of incremental power generated by the Xiaogushan hydropower plant is based on annual operation time of 3,882 hours and annual power generation of 396 million kilowatt-hours (kWh), excluding estimated transmission and distribution losses of 9.5% of the power generated. The valuation of economic benefits is based on end users' willingness to pay. In estimating willingness to pay, the result of the recent hydropower project¹ located on the same river as the Xiaogushan hydropower plant was applied. The amount of CNY0.61 per kWh was arrived at after the incremental cost of distribution and transmission of CNY0.16 per kWh was deducted from the estimated consumer surplus of CNY0.77 per kWh. These values are considered to be reasonable in view of the electricity consumption and tariffs to end users in Zhangye City, as presented in Table A10.1.

4. The Project also provides environmental benefits, which were not included in the reevaluation for lack of a methodology for quantifying them. These benefits include avoided pollution from alternative energy sources, improved human health and welfare as a result of the avoided air pollution, and positive impact on environmental resources due to avoided emission of carbon dioxide.

¹ ADB. 2006. *Report and Recommendation of the President to the Board of Directors on a Proposed Multitranche Financing Facility to the People's Republic of China for the Gansu Heihe Rural Hydropower Development Investment Program*. Manila.

Table A10.1: Electricity Consumption and Tariffs in Zhangye City in 2008

End-Users by Category	Electricity Consumed		Tariffs
	(GWh)	(%)	(CNY/kwh)
Agriculture	4,166	11.2	0.370
Residential	2,373	6.4	0.500
Commercial	4,054	10.9	1.095
Industrial	26,630	71.5	0.623
Total	37,223	100.0	
Weighted Average Tariff			0.638

Source: Zhangye City Statistics Annual Book 2008.

D. Economic Internal Rate of Return

5. The reevaluated EIRR for the Project is 27.1%, compared with 23.4% estimated at appraisal. The higher EIRR is attributed to the larger power generation volume and higher value of willingness to pay. The economic reevaluation result is presented in Table A10.2.

6. Sensitivity analysis was carried out to test the impact of (i) an increase in O&M costs, (ii) a decrease in benefits, and (iii) a combination of these two scenarios. According to this analysis, the Project will continue to be economically robust under these tested conditions. The project EIRR is more sensitive to changes in benefits than to changes in O&M costs. The results of the sensitivity analysis are set out in Table A10.3.

Table A10.2: Economic Reevaluation
(CNY million)

Year	Costs			Benefits	Net Benefits
	Capital	O&M	Total		
2002	13.88		13.88		(13.88)
2003	57.04		57.04		(57.04)
2004	155.99		155.99		(155.99)
2005	203.57		203.57		(203.57)
2006	97.48	5.43	102.91	117.88	14.97
2007	28.26	10.92	39.18	221.58	182.40
2008	6.75	10.23	16.98	203.35	186.37
2009		8.97	8.97	181.48	172.51
2010		9.06	9.06	181.48	172.42
2011		9.27	9.27	181.48	172.21
2012		9.45	9.45	181.48	172.02
2013		9.57	9.57	181.48	171.91
2014		9.57	9.57	181.48	171.91
2015		9.57	9.57	181.48	171.91
2016		9.57	9.57	181.48	171.91
2017		9.57	9.57	181.48	171.91
2018		9.57	9.57	181.48	171.91
2019		9.57	9.57	181.48	171.91
2020		9.57	9.57	181.48	171.91
2021		9.57	9.57	181.48	171.91
2022		9.57	9.57	181.48	171.91
2023		9.57	9.57	181.48	171.91
2024		9.57	9.57	181.48	171.91
2025	(173.85)	9.57	(164.28)	181.48	345.76

EIRR = 27.1%

() = negative, O&M = operation and maintenance, EIRR = economic internal rate of return.
Source: ADB estimates.

Table A10.3: Sensitivity Analysis

Cases	EIRR (%)	NPV (CNY million)
Base Case	27.1	452.6
(i) Energy generation reduced by 20%	24.3	335.37
(ii) Willingness to pay decreased by 20%	21.8	281.5
(iii) Operation and maintenance costs increased by 20%	26.9	447.1
(iv) Combination of (i), (ii), and (iii)	18.9	171.2

EIRR = economic internal rate of return, NPV = net present value.
Source: ADB estimates.

SUMMARY OF THE CLEAN DEVELOPMENT MECHANISM

1. In October 2003, the Xiaogushan Hydropower Company (XHC) started to apply for support for the Project from the World Bank's carbon fund. A professional team from the World Bank came to the project site four times to investigate and assess the technical engineering, social benefits, economic benefits, environmental protection, and community development. In June 2005 the World Bank and XHC officially signed an agreement on the purchase of quota for carbon emission reduction (CER) from the Project. The purchase period is 10 years, from 2006 through 2015. According to the agreement, during the 10-year period the total CER volume will be 3 million tons, and the total purchase value will be \$13.5 million (CNY110 million). This is the first hydropower project in Asia and the Pacific that has transacted with the carbon fund. It has built a good model for developing clean energy projects in the People's Republic of China.

2. In 2006 XHC began to receive income from the carbon fund. This special income is believed to have increased by CNY0.03 per kilowatt-hour (kWh) the current electricity tariff set for the Project, improving the company's financial viability. After completion, the Project can reduce 300,000 tons of carbon dioxide (CO₂) emissions or substitute 150,000 tons of coal. XHC has committed to take out CNY1.2 million each year from the carbon fund income to support local development in the project area. Meanwhile, the Zhangye municipal government will take out CNY1.18 million, or 5% of the tax amount paid by the Project to the local tax bureau, to promote environmental protection in the project area. As a result, a total of CNY2.38 million created by the Project each year will be spent on social development and environment protection.

3. In view of the successful Clean Development Mechanism experience of the Xiaogushan project, two other projects along the same river—the Erlongshan and Dagushan hydropower projects, which the Heihe Hydropower Development Company (XHC's parent company) has also invested in and loans from the Asian Development Bank (ADB) have partly financed—are either applying for or receiving the same support from international carbon reduction funds. The two projects will reduce emissions of CO₂ each year by 144,600 tons (Erlongshan) and 174,000 tons (Dagushan). The Erlongshan Hydropower Project is registered with the executive board of the United Nations Framework Convention on Climate Change as a Clean Development Mechanism project and is the first successful cooperation project with the Asia Pacific Carbon Fund under ADB. About 700,000 tons of CO₂ CERs can be generated and CNY75 million in emission reduction benefits made available. The Asia Pacific Carbon Fund has paid CNY25.65 million in emission reduction benefits in a one-time advance to Erlongshan Hydropower Company, greatly optimizing its investment structure and contributing to the reduction of greenhouse gas emissions.

ENVIRONMENTAL IMPACT ANALYSIS

A. Introduction

1. The Gansu Clean Energy Development Project comprises a 102 megawatt (MW) hydropower facility and 27 kilometers (km) of 110-kilovolt (kV) transmission line in Zhangye City, Gansu Province. The Project is classified as environmental category A by the Asian Development Bank (ADB). The environmental impact assessment (EIA) concluded that the Project would have significant positive environmental impact in avoided air pollution from conventional fossil fuel energy sources. Adverse environmental impact is minimal and can be mitigated through (i) proper construction; (ii) rational disposal of excavated soil and rock; (iii) proper treatment of wastewater during project construction; and (iv) restoration of construction sites, temporarily occupied land, gravel mining and washing sites, and waste rock sites.

2. A summary EIA report, based on the EIA report prepared by the Gansu Environment Protection Research Institute and approved by the Gansu Environment Protection Bureau, was circulated to ADB's Board of Directors on 30 April 2003. The Xiaogushan Hydropower Company (XHC), as the implementing agency, had asked the State Environmental Protection Administration to review the EIA report; on the basis of this review, the EIA level had been elevated from grade III to grade II, and additional air, water, and aquatic biota tests had been conducted. The Gansu Environment Protection Bureau, the Forest Bureau, and the State Environmental Protection Administration approved the EIA report on 21 April 2003.

3. The completion of soil and water conservation measures according to national laws and regulations, as proposed in the EIA report, were reviewed and endorsed by the Gansu Soil and Water Conservation Bureau in September 2008. The final completion review for environmental protection and management will be conducted in August 2009.

B. Institutional Setup and Environmental Management

4. During construction, an environmental management department was established within the XHC to coordinate the implementation of the environmental management plan including environmental monitoring. The vice president of XHC was made head of the department, which comprised one full-time staff and three representatives from three villages in the project area. During construction, each construction company set up an environmental division to look after the implementation of mitigation measures. The Zhangye Environmental Protection Bureau, through the Zhangye Environmental Monitoring Station, was responsible for monitoring air, water, noise, solid wastes, and ecological impact, and supervising the implementation of environmental mitigation measures in the project area. The Zhangye Forestry Bureau was responsible for monitoring soil erosion and supervising the implementation of soil and water conservation measures. In addition, XHC hired two companies¹ to oversee and supervise environmental protection associated with engineering construction, and to prepare semiannual monitoring reports, which were included in the project progress reports and submitted to ADB periodically.

5. For the operation phase, an environmental management unit headed by the XHC vice

¹ Yellow River Engineering Consulting Company and China Northwest Water Conservancy and Hydropower Engineering Consulting Company.

president was established at the head office to look after daily environmental management matters related to the plant operation.

6. At appraisal, the total cost of environmental protection and mitigation measures was estimated at CNY6.48 million. According to XHC's completion report, the actual investment for environmental protection was CNY20.3 million, including investments for slope stabilization, ecological rehabilitation, and soil and water conservation. Access road protection and maintenance and ecological conservation for the reservoir and living areas are included in the regular operational management of the plant.

C. Environmental Impact and Implementation of Mitigation Measures

1. Terrestrial

7. The Project occupied 137.25 hectares, including plant and weir diversion structures, disposal sites and borrowing pits, and access roads. It produced 740,000 m³ of spoils. During construction, topsoil layers were replaced and slope stabilization measures were undertaken effectively to control erosion. Retaining walls and necessary re-vegetation measures were employed to protect disposal piles. Drainage facilities were built into roads, excavated slopes, and spoil piles. Vegetative measures, including shrubs, grass, and trees, were also taken where appropriate. As a whole, erosion control and re-vegetation measures taken were adequate in engineering design and were accepted and endorsed by the Gansu Soil and Water Conservation Bureau in September 2008. Necessary measures will be continuously taken to prevent erosion problems during operation.

2. Aquatic

8. A special gate with a discharge capacity of 1.6 cubic meters per second (m³/s) was built. This allows a minimum water flow to the original river section during dry seasons. For the ecological flow requirement during flooding seasons (July–August), a water flow of at least 40 m³/s can be released to the river according to operating records.² This has met the requirement of a minimum flow of 21.6 m³/s during flooding seasons for ecological purposes, set in the EIA. Moreover, the minimum ecological flow requirements have been strategically considered by the Government as well as the plant management and will be maintained. According to the monitoring results, inflow and outflow water quality have all met class I standards of the National Standard for Surface Water Environmental Quality (GB3838-2002).

9. So far no significant impact on aquatic species has been observed, but further monitoring will continue. The XHC has agreed that appropriate management strategy will be implemented if any sensitive aquatic species are discovered.

3. Solid Waste and Wastewater

10. During construction, wastewater from workers' residential camps was treated in biological septic tanks and solid waste was transported to landfills. A wastewater treatment

² The EIA requires the release of at least 20 m³/s of water to the original river section during flooding seasons to meet the ecological demands of the river basin. According to the operating records of the plant from 2007 to 2008, the average inflow in July–August was about 150 m³/s, while the peak flow into the plant was about 100 m³/s. Therefore, an overflow of at least 40 m³/s can be released to the river.

facility with a capacity of 2 m³/d was established to treat wastewater from the residential area during operation. Solid waste yield during operation is insignificant; it comes mainly from the residential area and is transported to municipal landfills.

4. Noise

11. During construction, workers on-site were exposed to noise from excavation, vehicles, rock material processing, concrete mixing, and other processes involving machinery. Standard occupational health and safety tools such as protective gear were provided. During operation, noise is mainly from ventilators and air compressors in the central control room. Installing noise reduction devices and moving the air compressors outdoors will reduce the noise level.

D. Ecosystem Rehabilitation and Management

12. The reservoir area of the Project is in the experimental zone of the Qilian Mountain National Nature Reserve. Soil and water conservation measures are being implemented effectively in the reservoir area. Five percent of XHC's annual tax payments to the Zhangye municipal government go into a special fund to be used to finance projects, and to maintain and improve ecological functions in the reservoir area and the Qilian Mountain Nature Reserve. Projects are implemented jointly by the Zhangye Forestry Bureau and the local county or township government. The Zhangye Financial Bureau has issued financial management regulations specifically to manage the funds collected. In addition, a long-term project plan has been prepared for the use of the special fund (about CNY2.58 million) for works and projects in the reservoir protection area in 2007–2016. In 2007, CNY248,000 was allocated for 50 mu of afforestation, 4,000 mu of ecological rehabilitation, 2,000 mu of forest protection, and the capacity building of local forestry bureaus.³ Such institutional arrangements have provided a very effective financing instrument for the sustainable support of ecological conservation in the long run.

E. Environmental Benefits

13. The Project has yielded substantial positive environmental benefits through avoided air pollution from alternative energy sources. The hydropower plant provides more reliable electricity supply in the project area, reducing pressure on fuelwood collection and providing an option besides burning coal for cooking and heating with consequent indoor air pollution. A 5 MW plant and a 3.5 MW plant, both coal fired have been decommissioned as a result.

14. The Project produces clean energy and has very minor adverse ecological impact. Its benefits in the form of certified emission reductions (CERs) have been successfully traded through the Clean Development Mechanism.⁴ Since the start of plant operation and up to 2008, 750,000 tons of CO₂ greenhouse gas emissions had been reduced through CER trading.

³ A mu is a Chinese unit of measurement (1 mu = 666.67 square meters).

⁴ The Clean Development Mechanism deal was made with the carbon fund of the World Bank in 2005. The deal involved the purchase of a total of 3 million tons of CER from the Xiaogushan hydropower plant in 2006–2015 for \$13.5 million. The deal was the first Clean Development Mechanism trade with a hydropower project in Asia and the Pacific through the carbon fund.

F. Conclusions

15. During construction, all the contractors fulfilled their obligation to protect the environment and to implement mitigation measures in their construction schemes. The adverse effects of the project construction on the surrounding environment were thus minimized. During operation, there has been very little negative impact on the environment. The necessary environmental management approaches have been integrated into operations. Moreover, the Project will produce significant environmental benefits by providing clean energy and reducing air pollution from conventional coal-fired power plants.

EVALUATION OF LAND ACQUISITION AND RESETTLEMENT ACTIVITIES

A. Scope of Land Acquisition and Resettlement

1. The resettlement plan was prepared by the Xiaogushan Hydropower Company (XHC) and approved by the Asian Development Bank (ADB) in December 2002. According to this plan, the land acquisition and resettlement impact was considered minor and insignificant. A total of 148.2 mu¹ (9.88 hectares) of land would be permanently acquired, and 129.18 mu of land would be temporarily used during implementation. The acquisition of land for project construction would directly affect 29 persons (six households)—17 persons (two households) affected by permanent land acquisition, and 12 persons (four households) affected by temporary land use. No residence would have to be relocated. The land acquisition impact on local minorities was very minor. A special community development plan was formulated and implemented under the Project to directly benefit the local minorities.

2. According to the project completion report prepared by XHC, the resettlement began in early 2002 and was completed by the end of 2005. In total, 639.7 mu of land was permanently acquired (332% more than the estimate in the resettlement plan) and 284.8 mu was temporarily used (120% more than the plan estimate). The land acquisition affected 59 persons in 14 households—11 persons in 3 households affected by both permanent land acquisition and temporary land use, and 48 others in 11 households, who were affected only by temporary land use during construction. In addition, two sheepfolds were demolished. Table A13.1 presents the actual project impact compared with the impact foreseen in the resettlement plan.

Table A13.1: Project Land Acquisition and Resettlement Impact

Item	Unit	Amount
A. Permanent Use of Land		
Resettlement plan	mu	148.2
Actual	mu	639.7
Actual versus resettlement plan	%	332
In which, grassland		
Resettlement plan	mu	148.2
Actual	mu	98.2
Actual versus resettlement plan	%	(34)
B. Temporary Use of Land		
Resettlement plan	mu	129.2
Actual	mu	284.8
Actual versus resettlement plan	%	120
C. Affected Population		
Resettlement plan	persons	29
Actual	persons	59
Actual versus resettlement plan	%	103

() = negative.

Sources: Resettlement plan; project completion report; XHC.

3. The amount of land that was permanently acquired increased significantly from 148.2 mu to 639.7 mu for the following main reasons: (i) 472 mu of wasteland in the reservoir area, for the reservoir, connection road, and the transmission line, was not included in the resettlement plan; (ii) compensation had to be paid for 50 mu of land behind the power plant that became less accessible after project construction; and (iii) 24.8 mu of forestland that

¹ The mu is a Chinese unit of measurement (1 mu = 666.67 square meters).

belonged to the State was not included in the resettlement plan. In addition, the amount of land in temporary use increased from 129.2 mu to 284.8 mu because of design changes made in some subcomponents during project implementation.

B. Resettlement Policy and Compensation Rates

4. Land acquisition and resettlement were implemented according to the resettlement plan, and the Land Administration Law (1998) and the Grassland Law (1985) of the People's Republic of China. According to the resettlement plan, the compensation rates for permanent land acquisition, including land compensation and resettlement subsidy, would be calculated on the basis of 14 multiples of average annual output value per mu for cultivated land (if applicable), 10 multiples of average annual output per mu for good-quality grassland, and 8 for desert grassland. The compensation rate would be CNY800 per mu for good-quality grassland, and CNY224 per mu for desert grassland. The actual compensation rates were generally higher than those mentioned in the resettlement plan, and the actual compensation rate for desert grassland was the same as that for good-quality grassland. Table A13.2 compares the actual compensation rates with those given in the resettlement plan.

Table A13.2: Compensation Rates
(CNY/mu)

Item	Resettlement Plan	Actual
A. Permanent land acquisition		
Good quality grassland	800	—
Desert grassland	224	800
Forest land	—	3,100
B. Temporary land use		
Good quality grassland	160 + restoring fee	≥ 240
Desert grassland	56 + restoring fee	≥ 84

— = no data available.

Sources: Resettlement plan; XHC.

C. Resettlement Measures and Income Restoration

5. The project impact was very minor: only three households were affected by permanent land acquisition, and the degree of impact ranged from 0.33% to 2.17%. Table A13.3 presents the detailed impact for each household due to permanent land acquisition.

Table A13.3: Degree of Impact on Affected Households
(mu)

Affected Household	Contracted Land				Permanent Land Acquisition	Percentage (%)
	Area of Contracted Grazing Land			Irrigated Land		
	Total	Fodder for Spring	Fodder for Autumn			
Huang Bao'an	2,453	837	1616	2	53.1	2.16
Qin Wanyou	1,297	489	808	1	28.2	2.17
Qin Yongfu	5,184	1,956	3,228	4	16.9	0.33
Total	8,934	3,282	5,652	7	98.2	1.10

Sources: XHC; survey conducted by ADB.

6. In addition to cash compensation, XHC promised to provide annual fodder subsidy to households that were relatively seriously affected by permanent or temporary land acquisition between 2005 and 2012, before land adjustment within the village. A total of CNY7,228 per year has been disbursed by XHC for this purpose (Table A13.4). Six affected households received a

total of CNY29,705 in annual subsidies from 2005 to 2008. The special subsidy has largely helped to mitigate the loss of fodder from the acquired land. The external resettlement monitoring report prepared in 2007 concluded that the project impact on affected households is limited, and that the affected households have stable livelihoods and productive status.

Table A13.4: Fodder Subsidy for Affected Households

Affected Household	Amount of Affected Grassland ^a (mu)			Annual Fodder Subsidy (CNY/year)		
	Total	Good quality grassland	Desert grassland	Total	Good quality grassland	Desert grassland
Huang Bao'an	98.9		98.9	2769.2		2769.2
Bai Shoushan	43.6		43.6	1220.8		1220.8
Bai Feng	65.4		65.4	1831.2		1831.2
Qin Wandong	0.5	0.5		40.0	40.0	
Qin Wanyou	29.0	0.8	28.2	853.6	64.0	789.6
Qin Yongfu	17.4	0.5	16.9	513.2	40.0	473.2
Total	254.8	1.8	253.0	7228.0	144.0	7084.0

^a Includes both permanent land acquisition and temporary land use.

Source: XHC.

D. Land Acquisition and Resettlement Cost

7. The total actual cost of land acquisition and resettlement was CNY671,193, 336% of the CNY200,000 estimated in the resettlement plan, mainly because the cost of resettlement monitoring and some other management fees were not included in the resettlement plan. The land acquisition and resettlement costs were totally funded by XHC. Table A13.5 gives details of the resettlement costs.

**Table A13.5: Land Acquisition and Resettlement Cost
(CNY)**

Item	Resettlement Plan	Actual	Actual versus Resettlement Plan (%)
1. Permanent Land Acquisition	89,760.00	155,440.00	173
a. Grassland	89,760.00	78,560.00	88
i. Good Quality Grassland	78,560.00	0.00	0
ii. Desert Grassland	11,200.00	78,560.00	701
b. Forestland	—	76,880.00	—
2. Structure (Sheep-shed)	15,000.00	15,000.00	100
3. Temporary Land Use	70,240.00	44,939.70	64
a. Good Quality Grassland	—	2,112.00	—
b. Desert Grassland	70,240.00	42,827.70	61
4. Forest Vegetation Restoring Fee	—	162,700.00	—
5. Resettlement Management fee	5,000.00	10,143.50	203
6. Land Management Fee	—	54,870.00	—
7. Water and Soil Reservation Fee	—	68,100.00	—
8. Monitoring and Evaluation Fee	—	160,000.00	—
9. Contingency	20,000.00	—	0
Total	200,000.00	671,193.20	336

— = no data available.

Source: Resettlement plan, and XHC.

E. Institutional Arrangement

8. The Zhangye municipal government, the Sunan County government, and XHC set up organizations such as a project leading group, a project resettlement office, a township resettlement working group, and a village resettlement working group during the resettlement. XHC and the village resettlement working group had key roles in the resettlement. XHC took on most of the resettlement responsibilities, including land survey and confirmation, negotiation of compensation standards with affected herder families, and delivery of compensation and subsidy to affected herder families.

F. Monitoring and Evaluation

9. The recruitment of the external monitor was delayed, and baseline information was gathered quickly in early 2006 to make up for the delay, largely affecting the accuracy of baseline information on affected households. XHC hired Lanzhou University as the external resettlement monitor in early 2006 to conduct independent monitoring and resettlement for the Project. Two monitoring reports were submitted to ADB in 2006 and 2007.

G. Participation and Information Disclosure

10. Participation and information disclosure were not efficient in the early stages of resettlement. The affected households, not understanding the map, were not clear about the boundaries of the acquired lands. XHC later prepared and distributed information booklets to affected households to clarify the amount of land acquired, the resettlement policy, and compensation rates.

H. Lessons and Recommendations

11. In general, the land acquisition and resettlement were implemented well. In addition to cash compensation for grassland acquired for the Project, XHC has provided annual fodder subsidy to households that were relatively seriously affected. This is good practice and can be applied in future projects where the situation is similar. The cost of land acquisition and resettlement was not adequately budgeted because fees levied by the government were underestimated. The cost of land acquisition and resettlement should be adequately provided for in future projects.

SOCIAL IMPACT, POVERTY REDUCTION, AND COMMUNITY DEVELOPMENT

A. Introduction

1. The main objective of the Project was to help improve the environment in Zhangye City by making clean energy more accessible. A social and poverty analysis was conducted during project preparation. According to that analysis, the Project would benefit the poor largely through increased economic opportunities. At its peak, the construction of the Xiaogushan hydropower plant (XHP) would employ 3,000 people. About 100 permanent staff would be employed during the operation of the plant. Among the ethnic minorities living in the project area, those most directly affected by the Project would be the Zang and the Yugur. The construction would have very localized impact on two villages in Xishui Township. On the other hand, the local communities would benefit economically from their proximity to the construction activities and later to the powerhouse operation. The Xishui Township government also drafted a community development strategy and plan to ensure that the economic benefits from the Project could be properly managed to strengthen the communities in consonance with traditional values and customs.

B. Sustainable Socioeconomic Growth in the Project Areas

2. Zhangye City is a poor area of Gansu with a traditionally deficient supply of energy. In 2001, the Zhangye network experienced load shedding of 1,975 hours. The supply shortage seriously affected regional socioeconomic development in Zhangye City. The construction and operation of XHP has helped to fill the deficits in supply, improved the reliability of supply during peak hours, and consequently contributed to regional economic growth. In addition, the taxes paid by the Project during construction and operation have also contributed directly to the growth of local government fiscal revenues, which can be used to improve social services and to invest in economic development activities. The statistical data show that socioeconomic conditions in Zhangye City have improved rapidly in recent years. From 2002 to 2007, per capita gross domestic product (GDP) in Zhangye City increased by 93%, or by an average of 14% yearly, from CNY5,979 to CNY11,514. Per capita government fiscal revenues increased by 118%, or by an average yearly rate of 16.9%, from CNY381 to CNY832. Rural per capita net income grew by 34%, from CNY3,092 to CNY4,137 (Table A14.1).

Table A14.1: Socioeconomic Growth in the Project Areas
(CNY/person)

Region	Year	Per Capita GDP	Growth Rate (%)	Per Capita Fiscal Revenue	Growth Rate (%)	Per Capita Rural Net Income	Growth Rate (%)
Countrywide	2002	9,398		1,472		2,476	
	2007	18,934	101	3,893	164	4,140	67
Gansu Province	2002	4,768		567		1,590	
	2007	10,335	117	1,499	164	2,329	46
Zhangye City	2002	5,979		381		3,092	
	2007	11,514	93	832	118	4,137	34
Shandan County	2002	6,119		208		3,001	
	2007	10,269	68	465	124	4,049	35
Minle County	2002	4,225		164		2,765	
	2007	7,008	66	342	109	3,703	34
Ganzhou District	2002	6,619		289		3,255	
	2007	13,349	102	848	194	4,342	33
Linze County	2002	6,402		293		3,144	
			95		102		34

Region	Year	Per Capita GDP	Growth Rate (%)	Per Capita Fiscal Revenue	Growth Rate (%)	Per Capita Rural Net Income	Growth Rate (%)
Gaotai County	2007	12,454		592		4,226	
	2002	5,775	99	234	179	3,111	34
Sunan County	2007	11,498		652		4,170	
	2002	7,969	147	745	552	3,895	29
	2007	19,711		4,855		5,006	

Sources: 2002 and 2007 statistical yearbooks of Zhangye Prefecture.

3. XHP is in Xishui Township, Sunan County. There were 1,135 residents (296 families) in Xishui Township by the end of 2007, around 90% of them Zang people. The other nationalities represented in Xishui are the Hui, the Yugur, the Mongolian, and the Han. The construction of XHP largely improved local transportation and communication. The local people now have easier access to outside markets, where they can sell their livestock products, and can obtain market information through the internet and mobile phone. According to the Hydropower Company (XHC), the average per capita income in Xishui Township in 2007 was around CNY5,000, almost 5 times the average in 2002.

C. Poverty Reduction in the Project Area

4. The incidence of poverty in the project area has been significantly reduced during project implementation. Between 2001 and 2007, the total number of people living in relative poverty in the rural areas of Zhangye City decreased by 75%, from 293,098 to 72,193. A total of 220,905 people were lifted above the relative poverty line. The poverty incidence rate in Zhangye City also declined by 22 percentage points, from 30% to 8% (Table 14.2).

Table A14.2: Poverty Incidence in the Project Areas
(persons)

District /County	2001			2007		
	Rural Population	Poverty Headcount (<CNY825/person)	Poverty Incidence (%)	Rural Population	Poverty Headcount (<CNY1,196/person)	Poverty Incidence (%)
Shandan	146,221	74,041	51	145,618	15,602	11
Minle	215,839	121,609	56	206,221	17,908	9
Ganzhou	345,649	47,531	14	324,089	17,313	5
Linze	121,279	21,443	18	124,084	7,040	6
Gaotai	130,832	22,840	17	132,711	10,950	8
Sunan	23,803	5,634	24	25,215	3,380	13
Total	983,623	293,098	30	957,938	72,193	8

Source: Zhangye City Poverty Reduction Office; 2001 and 2007 statistical yearbooks of Zhangye Prefecture.

5. The Zhangye municipal government has implemented a social security policy for the poor. In addition to the urban poverty people, 59,818 rural residents were included in the minimum-living-standard security system in 2008. Each poor person receives a monthly living allowance of CNY40; the amount will be adjusted as living standards increase. In addition, the municipal government provides an annual living allowance of CNY3,900 to each five-guarantee household. In 2008, a total of 7,398 five-guarantee households in Zhangye City, 136 of these in Sunan County, received the special allowance.

D. Community Development

6. To ensure that the project benefits promote the development of local communities in harmony with traditional values and customs, a community development strategy and plan was

prepared during project preparation and the early stages of implementation, and is being implemented by XHC and the local governments. The plan covers local roads improvement, education, health, religious protection, electricity supply, water supply, telecommunications, technical training, and job opportunities. In addition to those costs included in the project budget, CNY854,100 had been disbursed by XHC as of the end of 2008.

7. The implementation of the development plan has greatly promoted local community development in Xishui Township: (i) 80 kilometers of class 4 highway passing through five villages was constructed from Dayekou to XHP, giving the local people access to the township, the county site, and Zhangye City; (ii) Xishui Primary School received CNY117,400 for (a) computers, (b) classrooms with toilets and playground, (c) bilingual education, and (d) scholarships for students from poor families; (iii) CNY74,000 was used to improve medical services in a community clinic, and to finance annual physical examinations for 145 local villagers since 2006; (iv) a 35 kV transmission line was built from Longshou to Xiaogushan in 2003, and the local resident power grid was also updated, so that the residents now enjoy reliable power supply, and electricity tariffs have declined from CNY0.98–CNY1.1 per kilowatt-hour (kWh) to CNY0.51/kWh; (v) tap water supply projects were constructed in Louzhuangzi and Bajiaowan villages in 2007; (vi) a computerized telephone network and mobile communication towers were put up in 2005, and almost every family now has one landline phone and one mobile phone; (vii) XHC donated CNY85,000 for the repair of the Zhuanglun Temple; and (viii) CNY43,000 was used to pay for the services of experts who provided training in livestock breeding, planting, health, and biogas utilization.

E. Labor and Employment

8. According to XHC, 1,325 local laborers worked for the Project during its construction from 2003 to 2006. The laborers were mostly from Louzhuangzi and Bajiaowan villages in Xishui Township, and the rest were from Anyang, Huazai, and Mati townships in Zhangye City. With the skills they gained in civil works, many of the laborers were hired for other projects after the construction of XHP. In Louzhuangzi Village, 40 persons (20% of the village population) found work outside the village, and 23 of these settled in urban areas. Around 20 persons in Bajiaowan Village leave each year to find jobs outside the village. Migrant work is becoming a major source of income for the local people. In addition, XHC has so far hired around 70 staff for plant operation and maintenance; all of them were recruited locally in Zhangye City.

F. Education

9. The Tuition and Textbook Expenditures Remission Program of the Sunan county government provides free education from primary school to high school, for a total of 12 years. The subsidy covers tuition, textbooks, and residence in the school dormitory. In addition, the students receive living and travel allowances. The daily living allowance in school is CNY4 per student, while the annual travel allowance ranges from CNY60 to CNY300 per student, depending on the distance from home to school. The implementation of such a preferential policy, which applies to all enrolled students in the county, has greatly improved local education. The statistics yearbook 2007 shows that the enrollment ratio for school-age children in Sunan County is almost 100%.

G. Gender Development

10. Gender development has been greatly supported under the Project from the start, and particularly with the improvements made in transportation and communication. Before the Project, fewer people used to leave their communities in search of jobs; now most young people do, and about 20%–30% of migrants are female. Female employees enjoy wages equal to those of male employees for similar jobs. Women also participated actively in land acquisition and resettlement, particularly in the management of the compensation fund.

H. Monitoring and Evaluation

11. Lanzhou University was hired to monitor the resettlement, including its social impact. Two monitoring reports were submitted to ADB in 2006 and 2007. These reports concluded that the Project has contributed greatly to community development, poverty reduction, and gender development both during construction and during operation.

I. Conclusions and Lessons

12. The project has contributed to regional sustainable socioeconomic development, poverty reduction, and community development in the project areas.

- (i) The great importance attached by XHC to social issues throughout project implementation and operation has strengthened its relationship with the local communities.
- (ii) The formulation and implementation of the community development plan has greatly promoted the development of the local communities, and enabled the local people to enjoy the benefits from the Project in harmony with their traditional values and customs.
- (iii) Supplemental funds for community development are mobilized quite efficiently to achieve the community development plan.
- (iv) Since the Project has demonstrated an important and successful role for the community development plan throughout project preparation and implementation, such a plan may need to be mandatory in other similar projects in the PRC; in that case, provisions should be made for it in the project budget.

SUMMARY OF THE ASSESSMENT OF PROJECT PERFORMANCE

Criterion	Weight (%)	Assessment	Rating Value	Weighted Rating
Relevance	20	Highly Relevant	3	0.6
Effectiveness	30	Highly Effective	3	0.9
Efficiency	30	Efficient	2	0.6
Sustainability	20	Most Likely	3	0.6
Overall Rating		Highly Successful	N/A	2.7

Source(s): Asian Development Bank.