The People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan

Small-scale Hydropower Plant Construction Project in Gansu Province

External Evaluator: Naomi Ichimiya

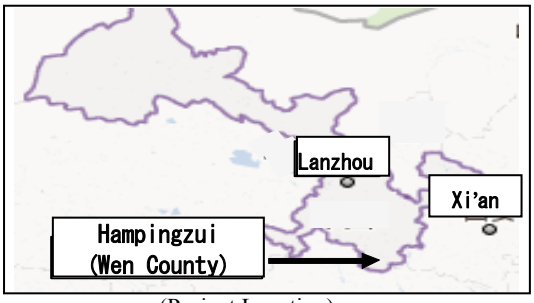
Foundation for Advanced Studies on International Development

0. Summary

This project has been highly relevant with China's development plan and development needs, as well as Japan's ODA policy at that time. The constructed small-scale hydropower plant has shown no major problem to produce the target value of 72 MW, demonstrating high effectiveness of this project. The project expenditure and period slightly exceeded planned values, but only to increase the project's effectiveness, or because the modification was unavoidable under the given circumstance at that time. Expected impacts are also observed; after the plant construction, within the power grid to which the plant supplied electricity, electric shortage was largely reduced. This led to development of local industries and increased income earned by the poverty population. The power station provides employment opportunities to the local residents and also pays careful attention and effective arrangements to the surrounding societies, an example of which is seen in the infrastructure development by the station. The station possesses sufficient technological, financial, operational, and staffing capabilities, demonstrating a high level of sustainability. In fact, operational conditions of the station are thought to be the best among the many small-scale hydropower stations in the region.

In light of the above, this project is evaluated to be fairly satisfactory

1. Project Description



(Project Location)

(Turbine Building, Hanpingzui Hydropower Plant)

1.1 Background

Electric power development has been given focus as a driving force to sustain high rates of economic growth in the People's Republic of China (hereinafter referred to as China). Even though supply capacity had rapidly increased, demand for electricity was likely to continue to grow after 2000 exceeding the increased supply capacity. Thermal power accounted for over 70 % of the national electricity production and was causing serious environmental problems. With its abundant supply of coal and pressure to sustain fast economic growth, China promoted the development of coal-fired power generation to meet the demand for electricity. China's equally abundant hydro resources were, on the other hand, mostly left unharnessed. More than 70 % of China's hydro capacity was located in

the inland western region, but less than 10 % of this potential had been utilized. Consequently electricity supply capacity in these areas remained limited. Under such circumstances, China faced challenges in the energy sector such as the diversification of power resources, the construction of hydro-electric power plants and electrification in inland rural areas, and poverty reduction through it.

The Gansu Province, the target province of this project, is located inland in the north western region of China, and is one of the least developed provinces nationwide. Under the nation's Western Development Program in 1999, Gansu Province was undergoing economic development with anticipation for an 8% GDP growth in 2000. Improvement of electric infrastructure in urban as well as rural areas was seen imperative in order to sustain such economic growth. Wen County of Longnan City, the plant construction site located in provincial boundary, was recognised as the state-level disadvantaged county though it has rich mineral and water resources. In Longan city, with a traffic and railway hub to connect between north-western and south-western part of China a steep increase in electric demand was anticipated. However its power supply did not increase to meet the demand and this hindered the economic development of the city.

1.2 Project Outline

The objective of this project is to improve electric supply capacity and prevent air pollution by constructing a small-scale hydropower plant with output control capability, thereby contributing to economic development and poverty reduction of the area.

Loan Approved Amount/ Disbursed Amount	6,543 million yen / 4,638 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March, 2001 / March, 2001
Terms and Conditions	-Interest Rate: 0.75 % -Repayment Period: 40 years (Grace Period: 10 years) -Conditions for Procurement: Within 6 years from signing the Loan Execution: - General untied
Borrower / Executing Agency(ies)	Gansu Province People's Government[1] /Guarantor: NA
Final Disbursement Date	October, 2007
Main Contractor (Over 1 billion yen)	-China Water Resources & Hydropower Engineering Bureau NO.11, China. -China National Electric Equipment Corporation, China.
Main Consultant (Over 100 million yen)	NA
Feasibility Studies, etc.	-Project Plan：Northwest Investigation Design and Research Institute, June, 1997. -Feasibility Study：Northwest Investigation Design and Research Institute, February, 1999. -Environmental Impact Assessment：Northwest Investigation Design and Research Institute, February, 1999 - Resettlement Plan：Northwest Investigation Design and Research Institute, February, 1999
Related Projects (if any)	This project was originally composed of Hanpingzui sub-project (Wen County, Longnan City, Gansu Province) and

[1] While this project's executing agency is the Gansu Province People's Government the actual construction was executed by Gansu Electricity Joint Corporation (Renamed to Gansu Keyuan Electric Corporation in 2009). This arrangement was done under policies of the Provincial Department of Finance to not directly execute infrastructure project, but instead entrust it to executing contractors.

	Longshou sub-project (Zhangye City, Gansu Province). The Longshou sub-project, due to circumstances at the Chinese side, later turned out from the loan scope. This project's mid-term review in 2005 confirmed that construction at Langshou had completed with Chinese budget.

2. Outline of the Evaluation Study

2.1 External Evaluator

Naomi Ichimiya, Foundation for Advanced Studies on International Development

2.2 Duration of Evaluation Study

Duration of the Study: Duration of the Study: November 2010 – December 2011

Duration of the Field Study: April 10th – April 23rd, 2010, and June 19th – June 23rd, 2011.

2.3 Constraints during the Evaluation Study (if any):

None

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

This project maintained a high level of relevance with China's development policies at the time of ex-ante evaluation as well as at the time of ex-post evaluation.

At the time of ex-ante evaluation, at the national level, China launched an electricity reform plan (1998 to 1999) which aimed, in part, to expand clean-energy utilization, prohibit new construction of small thermal power stations and shut down existing small thermal power stations as well. The clean-energy resources the government assumed included small- and medium-scale hydroelectric power generation and therefore construction of hydroelectric power plants was to be given priority in the 10th Five-Year National Development Plan (2001-2005). The plan also put stress on reducing poverty and developing the local economy especially in the mountainous areas of the mid-western region.

At the provincial level, in inland and water resource-rich Gansu Province, GDP per capita was below the national average and poverty rate in the rural area was worse than the national average. Hanpingzui Hydropower Plant construction was recognized as a major project in the 9th Five-year Plan of Gansu Province and Wen County, construction site for Hanpingzui Hydropower Plant, was set as a test county by the Chinese State Council for the model small-scale hydropower project for rural electrification in China.

At the time of the ex-post evaluation, at the national level the 12th Five-year Plan (2011-2015) was formulated. The energy policy in the plan and the energy strategy, the Xidian Dongsong ("generate the electricity in the West, send it to the East") envision the diversification of energy resources and the establishment of a system for safe, stable, efficient, and environmentally clean energy production, and in so

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③: High, ② Fair, ① Low

doing hydropower was promoted. It also aims at rural electrification at the county level and extension of small-scale hydropower capacity in rural areas by 10 million kW. In accordance, the 11th Five-year Renewable Energy Development Plan outlined importance to advance clean-energy technologies and utnilization of renewable resources such as abundant hydropower in rural areas.

At the provincial level, the 12th Five-year Plan (2011 - 2016) of Gansu Provincial set for designing hydro utilization plans including plant construction.

In light of the above, at the time of ex-post evaluation, this project was highly relevant with the state's as well as province's development plans.

3.1.2 Relevance with the Development Needs of China

This project maintains a high level of relevance with development needs of China as same as that of Gansu Province at the times of ex-ante evaluation as well as at the time of ex-post evaluation.

[Development Needs for Energy] In 1998 before the ex-ante evaluation, China's coal-fired power output amounted to more than 70 % of the national total, and the ratio of coal-fired plants was also high. This biased dependency caused problems including limited coal-transport capacities and air pollution in urban areas. On the other hand, China was rich in unharnessed hydro-electric resources. In the 2000s, China started to reduce its dependence on thermal power, and promote the utilization of renewable resources such as small-scale hydropower. By 2009, however, the ratio of thermal power in terms of output capacity remained around 75 %. The need for renewable clean energy, therefore; remained high.

[Regional Development Needs] In 1999, the Chinese government launched the Western Development Program to reduce disparities between the developed coastal east and the less developed inland west. Gansu Province became one of the targeted regions in this program. Wen County of Longnan City, this project's site, was recognized as a state-level disadvantaged county at the time of both ex-ante evaluation and ex-post evaluation. Income per capita in Wen County recorded 791.59 yuan[4] in 2000, whereas the national average was 2,253.42 yuan[5] in the same year. In 2009, the income per capita remained far below the national average; 2,220.00 yuan[6] in Wen Country while the national average was 5,153.17 yuan[7]. The population below poverty line was 51.8 %[8], with most of which being farmers, suggesting a county level of high development needs.

In Longnan City including Wen County electric supply was predicted to fall behind the demand increasing from economic development. For example, supply shortage was predicted to worsen from 27MW in 1999 to 56MW in 2003[9]. In the post-evaluation period, as shown in the below figure, demand and supply in Gansu Province in 2008 doubled from the 2000 level as a result of regional development. Supply increased by 40 %, which was slightly overridden by 43% demand increase, enforcing the province

[4] Gansu Province. Gansu Yearbook. 2001. http://www.gsei.com.cn/ziliao/shuju/default.asp
[5] China National Statistics Office. China Statistics Yearbook. 2001 http://www.stats.gov.cn/english/statisticaldata/yearlydata/YB2001e/ml/indexE.htm
[6] Gansu Province. Gansu Yearbook. 2010. http://www.gsei.com.cn/ziliao/shuju/gansu2010/default.htm
[7] China National Statistics Office. China Statistics Yearbook. 2010. http://www.stats.gov.cn/tjsj/ndsj/2010/indexeh.htm
[8] Gansu Development and Reform Committee. Gansu Province Analysis on Serious Issues in the First Half of 12th 5-Year Plan. http://www.gspc.gov.cn/gs125gh/ShowArticle.asp?ArticleID=3972, 2010/3/302
[9] JICA Documents (Ex-ante Evaluation Appraisal)

government to import surplus electricity from outside of the province.

In light of the above, this project at the times of ex-ante evaluation as well as at the time of ex-post evaluation has met needs of national energy policy as well as regional development needs.

Table 1 Electric Demand and Supply in Gansu Province

Unit: Twh Unit:%

Contents \ Year	2000	2005	2007	2008	2005	2008
Electric Supply	**295.34**	**489.48**	**614.74**	**677.76**	**Account for the supply**	
Province Supply	280.27	506.17	618.76	690.39	-	-
Hydro	114.36	166.47	194.39	222.35	33%	32%
Thermal	165.91	339.70	424.37	468.04	67%	68%
Imported Supply	46.86	51.14	61.26	58.86	-	
Exported Supply	-31.78	-67.83	-65.28	-71.49	-	-
Electricity Consumption	**295.34**	**489.48**	**614.74**	**677.76**	**Account for the Consumption**	
Farming, Forestry, Animal Husbandry, Fishery and Irrigation	41.45	51.70	52.65	55.26	14%	8%
Industry	209.52	364.46	472.85	520.43	71%	77%
Construction	2.66	4.08	4.46	5.82	1%	1%
Traffic, Transportation, Storage and Post	9.21	15.34	24.61	27.71	3%	4%
Wholesale and Retail Trade	3.22	6.72	7.62	8.44	1%	1%
Others	7.80	14.72	16.25	19.47	3%	3%
Households	21.48	32.46	36.30	40.63	7%	6%

Source: Gansu Province Statistics Yearbook

Table 2 Electric Demand and Supply in Longnan City

Unit: Twh Unit:%

Contents \ Year	2000	2005	2010	Growth Rate in 2005 (from 2000)	Growth Rate in 2010 (from 2000)
Electricity Consumption	**72,120**	**174,824**	**288,276**	142%	300%
Farming, Forestry, Animal Husbandry, Fishery and Irrigation	12,875	10,918	15,208	-15%	18%
Industry	45,753	139,713	204,559	205%	347%
Construction	567	396	9,591	-30%	1592%
Traffic, Transportation, Storage and Post	651	544	754	-16%	16%
Information Technology	674	380	1,394	-44%	107%
Hotels and Catering	1,174	1,268	2,539	158%	579%
Financial and Real Estate		521	1,483		
Government Offices		1,236	3,944		
Households	10,426	19,848	48,804	190%	368%

Source: Gansu Province Statistics Yearbook

The Chinese government launched New Village Construction Program in 2005 to improve under-developed rural areas by, for example, constructing infrastructure. Small-scale hydropower plants in China are known for promoting infrastructure development in addition to its economic impact with marginal environmental damage. This also supports that this project to construct small-scale hydropower plants in under-developed rural areas meet regional development needs.

3.1.3 Relevance with Japan's ODA Policy

This project maintained a high level of relevance with Japan's ODA policy at the times of ex-ante evaluation.

Economic Cooperation Plan for China (2001), launched at the time of ex-ante evaluation, called for

protection of seriously threatened environment and social development in inland areas. Its major issues included 1) cooperation for global issues such as environmental problems, 2) support for reformation and liberalization, and 3) assistance for poverty.

At the time, ODA Loan Plan for China by JBIC emphasized importance of three topics: 1) environment, 2) food and poverty, and 3) inland development to reduce regional disparities. Additionally, in the area of energy, assistance was focused on three issues: 1) promotion of hydropower development, 2) expansion of transmission capacity, and 3) desulfurization of thermal power plants. The Plan prioritized assistance for projects private capital could hardly support, such as poverty reduction through rural development and efficient hydro resource utilization.

In regard to Relevance, this project has been highly relevant with China's development plan and development needs, as well as Japan's ODA policy; therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The Hanpingzui sub-project construction was executed mostly as planned. The scale of generators was increased to 72 MW from its initial 60 MW. This increase in generation capacity was made considering the rated head and high-water flow set in the detailed design and a long-term benefit of the hydropower plant, also in accordance with the clean-energy promotion by the Chinese government.

Table 3 Summary of Planned and Actual Outputs

Hanpingzui Sub-project	Plans at Ex-ante Evaluation	Outcomes at Ex-post Evaluation	Reason for the Difference
Foreign Currency	Package 1 Generators Generators 60MW (20MW×3), Transformers	72 MW (24 MW×3)	Modified by the detailed design
	Package 2 Dam Construction Dam Structure (Reservoir capacity 51,000,000 m^3, 57 m height) and up- and down-stream weir construction	NA	—
	Package 3 Plant Construction Plant building and auxiliaries (incl. switch yards and transmission lines)	NA	—
	Package 4 Tunnel Construction Construction of intake tunnel and spillway tunnel, incl. steel structures.	NA	—
	Package 5 Construction Materials	NA	—
Local Currency	Tunnel Construction and Others Land consolidation for turbine building, drainage, front gate, down-stream bank consolidation	NA	—
	Consulting	NA	—
	Other Expenses Electric charges for construction, etc.	NA	—

Data given from Gansu Mingzhu Southern Hydropower Development Co. Ltd

3.2.2 Project Inputs

3.2.2.1 Project Cost (Sub-rating ③)

The expenditure under the Hanpingzui sub-project was 7,482 million JPY, a 123 % increase from the budget allocated at the time of ex-ante evaluation, however was seen mostly as planned considering the increase of the output.

Among the total budget, the Japanese ODA loan covered 4,638 million JPY, 100 % of the planned

value, whereas local investment reached to 2,844 million JPY and 161 % of the planned amount (as shown in Figure 3). The excess expenditure of local investment was however justifiable under the following circumstances: 1) Frequent rock falls were anticipated at the construction site, which necessitated extra budget for consolidation, and 2) Specification of road construction around the lake was upgraded, which raised its construction cost. Originally roads had been gravelled before the plant construction and would be left that way, but later the classification of the road was raised and so were their completion requirements, adding extra pavement, widened shoulders, and guardrails.

In China, small-scale hydropower plant construction in rural areas is often associated with nearby infrastructure improvement. The additional road construction along with the plant construction in this project was understandable given such circumstances. Therefore, increased local currency cost was thought to be a reasonable arrangement to meet the local circumstances.

Table 4 Planned and Actual Cost of the Project

Unit: Million JPY

Subproject	Allocation*1			Execution			Ratio		
	Foreign Currency	Local Currency *2	Total	Foreign Currency	Local Currency *2	Total	Foreign Currency	Local Currency *2	Total
Hanpingzui	4,337	1,767	6,104	4,638	2,844	7,482	1.00	1.61	1.28
Longshou	1,800	3,374	5,174	—	—	—	—	—	—
Price Rise	94	82	176	—	—	—	—	—	—
Budget Reserve (5%)	312	206	518	—	—	—	—	—	—
Total	6,543	5,430	11,973	4,638	2,844	7,482	—	—	—

*1 Based on the amendment of the loan agreement agreed on November 2005.Source: JICA
*2 Local Currency 1 yuan = 14.36 JPY (Average rate during the loan period by ORANDA, years 2001 through 2007)

3.2.2.2 Project Period (Sub-rating ②)

Project period of this project was longer than planned. At the time of ex-ante evaluation this project's period was set to be 37 months, from March 2001 (L/A Signing) to March 2004. It turned out that the project ended (and hence plant operation started[10]) in September 2005, resulting actual period to be 55 month. (See Table 5 for details).

Table 5 Planned and Actual Periods of Sub-projects

Sub-project	Planned		Actual	
	Start	End	Start	End
Hanpingzui	March, 2001 (L/A Sign)	March, 2004 37 months	March, 2001 (L/A Sign)	Sept. 2005 55months

Source: JICA Documents

The major reasons for the delay include 1) unexpected consolidation of the crumbling project site, 2) extra roadwork periods for raised classification level of roads around the dam, and 3) work suspension for 6 months (from March to August) due to SARS outbreak in 2003. Especially during the SARS outbreak in 2003, in addition to preventing proliferation in the construction workers' camp, procurement then construction work was delayed because of economic and social stagnation at the state level.

[10] As defined by Project Memorandum in April, 2001.

As for Efficiency, in light of the above, the project period and cost slightly exceeded the plan, but only for reasonable purposes, and therefore, the efficiency of this project is high.

3.3 Effectiveness[11] (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

At the Hanpingzui small-scale hydropower plant, even though the Sichuan Earthquake in August 2008 caused damages to structures such as dam weirs and generators, at the time of ex-post evaluation they were operating normally. The facility's output capacity / maximum output increased to 72 MW from the initially planned 60 MW. This plant was built as a base-load plant designed to reduce electric shortage of the region. Increased output capacity / maximum output is therefore considered to be enforcement to this project's objective by improving electric supply capacity.

Unplanned outrage, initially planned to be 6 days, eventually did not occur at all. Excluding the previously described suspension following Sichuan Earthquake, unexpected suspension not even once happened, an indication that daily maintenance appropriately has been conducted. On the other hand planned outrage, initially planned to be 6 days, turned out to be 55 days. This was because frequency of scheduled inspection was increased from that of the initial plan. The three generators were alternatingly suspended for inspection, to avoid suspension of the all three generators at one time.

Table 6 Planed and Actual Operation and Effect Indicators

Measures [Unit]	I Target Values at Time of Ex-ante Evaluation	II Target values at Mid-term Review (2008)*1	III Results at Ex-post Evaluation (2010)*2
This Project's Output Capacity / Maximum output [MW]	60 (2005)	72 (24 Mw×3)	72 (24 Mw×3)
Unplanned Outrage [day/year]	NA	6 (Designed value)	0
Capacity Factor [%]	NA	5,051 hours (58%) (Designed value)	53.59 %
Net Electric Energy Production [GWh]	345 (Year Unknown)	364 (Designed value)	334.53
Planned Outrage [day/year]	NA	6 (Designed value)	55
Annual Total Volume of Inflow to the Reservoir [billion m^3/year]	NA	3.41	3.2
Beneficiaries [person]			
Wen County	NA	NA	25
Longnan City	264	264	268

Source: JICA Documents for I target values of ex-ante evaluation and II target values of mid-term review. For values at the ex-post evaluation from data given by Gansu Mingzhu Southern Hydropower Development Co. Ltd

*1 Goal values at mid-term review: proposed from the Chinese side at the time of mid-term review in 2005. Goal values were set equal to the designed values.

*2 Results at the ex-post evaluation: the 2010 data were the most current. The Sichuan Earthquake damaged structures such as dam weir at the Hanpingzui plant and its repair continued until 2009. Therefore, data values from 2010 were analyzed, instead of those from 2008 Data from 2008 would be used at the mid-term review

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

This project's financial internal rate of return (FIRR) turned out 0.2 % lower than expected at the ex-ante evaluation, as a result of recalculation under following conditions: 1) income from selling

[11] Effectiveness is scored also in the light of factors regarding Impact.

electricity was included in profit, 2) construction cost, operation and maintenance cost, and tax were included in expenses, and 3) project life was set 30 years.

Despite that the income from selling electricity was lower than it had been expected at the ex-ante evaluation, a number of staff members turned out half the expected number (140), consequently reducing labour and welfare expenses.

Table 7 Financial Internal Rate of Return（FIRR）

Sub-project	Ex-ante Evaluation Value	Recalculation at Ex-post Evaluation
Hanpingzui	4.1 %	3.9 %

3.3.1.3 CO_2 Reduction

This project's carbon reduction was calculated from total power output in 2010. It turned out to be 88 % of the goal value, thought fairly close to the targeted reduction value[12].

Table 8 CO_2 Reduction

Unit: ton / year

Sub-project	Target value（2008）	Achieved value（2010）
Hanpingzui	382,000	336,000

3.3.2 Qualitative Effects

Hanpingzui Hydropower Plant is physically located in Wen County, but at the same time was connected to Longnan Grid, outside jurisdiction of Wen County Office of Electricity[13].

A research by questionnaire and hearing was conducted to study electric supply conditions at the time of ex-post evaluation. This was done to 24 parties[14] including Wen County People's Government, The County's Office of Electricity, Longnan Electric Distribution Inc. (responsible for the Longnan distribution network to which Hanpingzui Hydropower Plant was connected), and various large electric users including companies and factories in Wen County and Longnan City. The study results showed users' high levels of reliability and satisfaction to electric supply.

Both Wen County government and Office of Electricity recognize that Hanpingzui Hydropower Plant earned a reputation for reliability for its stable voltage and network since its operation had started. This became a benefit of various companies, especially its large users, and contributed to economic development

[12] Calculated as was done at the ex-ante evaluation (following IPCC Guidelines for National Greenhouse Gas Inventories Reference Manual): Heat Equivalent of Yearly Electricity Output × Carbon Emission Intensity × Adjustment Constant for Uncombustion.

[13] Hanpingzui Hydropower Plant and the Longnan Grid: In the Baishuijiang River basin, where the Hanpingzui Hydropower Plant is located, there are five hydropower plants. Among them, the Hanpingzui Hydropower Plant possesses a large generation capacity, and is incorporated into a differnet distribution network than the other four. Since its operation started in 2005, the plant is connected to the Longnan Grid through two subplants (Yulei, Zaoyang). Transmission lines are the Bicheng / Zaocheng line extended to Chen County in Longnan City. The generation capacity of Hanpingzui Hydropower Plant is 14 to 15 % of capacity of Zaoyang subplant.

[14] Large users are classified as follows:

Areas	Large users classification
Wen County	10 Parties: Steel Industry - 4, Production and Sales -4, Metallurgy- 1, Mining - 1.
Longnan City (Cheng County)	14 Parties: Production-3, Mining-4, Electricity-1, Service-4, Commerce-1, Estate agent -1.

of Wen County. Electricity in Wen County depends solely on hydropower. By promoting small-scale hydropower projects, electric supply became abundant and electric shortage in Wen County was remarkably reduced.

According to Longnan Distribution Office, before construction of the Hanpingzui plant, the main supplier had been a thermal power plant in Tianshui City, outside the grid, and this long-distance transmission caused extensive power losses. Completion of the Hanpingzui Hydropower Plant enabled within-grid electric supply, and the new electric source significantly improved reliability and stability. Hearing at Wen County Office of Electricity also revealed that electricity consumption in Longnan City increased by 2.5 fold from 2000 to 2005, but the rate of transmission loss decreased by 20 %, as supported by efficient electric supply from the nearby plant such as Hanpingzui Hydropower Plant.

Table9 Comparisons of Electricity Consumption and Transmission Losses in Longnan City

Unit: Mwh

	2000	2005	2010
Consumption	721,200	1,748,240	2,882,760
Transmission Losses	66,760	115,070	122,080
Rate of Losses	0.09 %	0.07 %	0.04 %

Source: Hearing at Wen County Office of Electricity

At the time of ex-post evaluation, not only sufficient supply of electricity was distributed throughout the eight counties and one ward in Longnan City, but also in the high-water season, occasionally surplus electricity was exported to outside the grid. There was no thermal power plant in the grid, but only multiple small-scale hydropower plants, with Hanpingzui Hydropower Plant being the largest and one of the earliest plants. Construction of this plant shortened the transmission distance, and as a result, reduced transmission losses.

Other two interview cases on large users in Wen City showed that there had been typically 2 to 3 days of blackout in one month before completion of Hanpingzui Hydropower Plant, resulting in suspending factory operation and consequent economic losses. After completion, starting in 2007, conditions largely improved and currently blackout hardly occurs.

A iron silicate production factory (Above)
A Tea Manufacture's shop (Below)

A study on the 14 large users in Longnan City showed that eight companies possessed dedicated cables from transformer subplants to their properties, and six companies possessed dedicated transformers. Each of them answered that there had been stable electric supply without blackout from the past 2005-2006 to present. These large users were located in centre of the Longnan grid, and in case of shortage, electricity was immediately imported from outside grid, and therefore hardly experience a blackout.

As for Effectiveness, in light of the above, this project has

largely achieved its planned objectives; therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended Impacts

This project's designated impact was economic revitalization and poverty reduction brought by improved electricity infrastructure, and it was seen in income increase among the farmers as well as revitalization of local industries.

Income par capita among farmers, which comprised most of the poverty population in Wen County and Longnan City, has been increasing especially since 2004-2005. For example, though the amount of income par capita was still low in Wen County, the increase rate from 2005 (the year when Hanpingzui Hydropower Plant was completed) to 2008 was 5.52 %, above the rates of Longnan City (4.99 %) and Lanzhou City (3.25 %), as shown in the figure below.

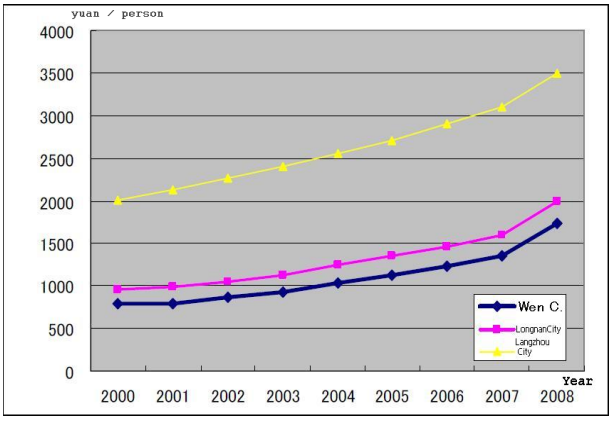


Figure 1 Income Increase par Capita

(Unit: Chinese yuan)

Region / Year	Wen County	Longnan City	Gansu Province
2005	1131	1353	2713
2006	1226	1464	2898
2007	1346	1600	3103
2008	1740	1998	3503
Increase rate from 2005 to 2008	5.53 %	4.99 %	3.25%

Source: Gansu Province Statistics Yearbook

The impact of Hanpingzui Hydropower Plant on local economy

-An interview record of an owner of iron silicate production factory

The main industries of Wen County are hydropower plants and production of iron silicate. There are 10 factories of iron silicate and the factories together employ more than 2,000 workers. There used to be blackouts two to three times in one month, and factories had to alternatingly suspend their operations. Once suspended, it would take two days to recover operational temperature in the furnaces. So altogether five to seven days were wasted. Back in 2004 and 2005, because of frequent blackouts, our business had almost gone bankrupt. Nowadays electric supply became fairly stable and we experience few operational trouble. Local employment increased, people's income went up, and we are becoming able to escape poverty.

All the 10 larger users in Wen County responded to the questionnaire with following answers; comparing before and after plant completion, there were i) increased part-time job opportunities to nearby farmers, ii) increased new and reformed housing, iii) improved road conditions and medical facilities, iv) increased investment from external parties.

The reason for i) increased part-time job opportunities was presumed to be the power plant actively supplying the job opportunities to the farmers. For ii) increased new and reformed housing, it was generally a reflection of increased income, presumably happening in Wen County. For iii) improvement of infrastructure such as communication, roads, medical facilities often accompanied small-scale hydropower plant construction in rural China, and this project seemingly has become another example of this trend; as previously described, roads around the dam was well paved, and new medical facilities, school buildings, and bridges were built or renewed by the plant company. Lastly, for iv), booming mining industry with abundant mineral resource in the county and tea manufacturing with Longjing tea (very rare in inland), both of which were activated by reduced electric shortage, has contributed to growth of investment from external parties.

Another study on large users in Longnan city (12 cases) collected following answers from almost all respondents.

-Economy: Increased profits for production and service industries.

-Income: Increased income par capita and job opportunities, and reduced emigration.

-Life: Reduced blackouts, improved security and infrastructure, and more convenient living.

However, precisely determining the impact of the plant construction on economic development required careful examination. This was because Hanpingzui Hydropower Plant was connected to the Longnan grid, and other industries were also developing under the on-going China's Western Development Program, making it difficult to determine the impact brought by the plant alone. It was commonly known that small-scale hydropower plant construction in under-developed rural areas in inland China promoted economic development in synergy with other development factors. Therefore, accomplishing initially designed impacts required appropriate coordination with other forms of development assistance.

3.4.2 Other Impacts

3.4.2.1 Impacts on the natural environment

At Hanpingzui Hydropower Plant, treatments were made to reduce noise, water and air pollution, and waste disposal by construction workers following suggestion from the environment assessment conducted by the Chinese side before the ex-ante evaluation, which called for precautious measures to prevent pollution of water in the dam and its downstream, to protect ecological systems, and to maintain scenery. According to Wen County People's Government, monitoring results have reported no major concerns about these factors.

For post-construction environmental monitoring, it was agreed at the time of ex-ante evaluation that the Wen County Office of Environmental Protection would inspect water quality up- and down-stream of the dam three times a year. At the time of ex-post evaluation, rearrangements of tasks among offices in the County resulted in transfer of this duty on environmental monitoring from Office of Environmental Protection to Office of Public Health. As shown in the below figure, before and after plant construction in 2005 show only marginal fluctuations, without signs of major problems. Wen County People's Government

expressed that electric supply reduced residents' use of firewood for cooking, which reduced air pollution by wood combustion.

Table 10 Results of Water Quality Monitoring on Hanpingzui Hydropower Plant

Measures	Period	2001	2002	2003	2004	**2005**	2006	2007	2008	2009	2010
pH	Dry season	7.1	7.2	7.4	7.3	**7.2**	7.5	7.5	7.3	7.4	7.5
	Normal Season	7.0	7.1	7.2	7.1	**7**	7.7	7.6	7.5	7.5	7.3
	Rainy season	7.1	7.1	7	7	**7.2**	7.4	7.3	7.2	7.2	7.2
Chromaticity [degree]	Dry season	5	5	5	5	**6**	6	6	6	6	6
	Normal Season	5	5	5	5	**6**	6	7	7	7	6
	Rainy season	5	5	5	5	**7**	6	7	7	7	6
SS [mg/l]	Dry season	2	2	2	2	**2.1**	2.1	2.1	2.2	3.5	3
	Normal Season	2	2.1	2	2.2	**2.1**	2.3	2.4	2.6	3.7	3.4
	Rainy season	2.1	2.3	2.2	2.4	**2.5**	3.2	3.1	4	4	3.6
BOD [mg/l]	Dry season	1.5	1.5	1.5	1.5	**1.8**	2	2.1	2.2	2	2
	Normal Season	1.3	1.3	1.3	1.3	**1.5**	1.8	1.6	1.9	1.7	1.5
	Rainy season	1.2	1.2	1.2	1.2	**1.4**	1.5	1.4	1.5	1.5	1.3
COD [mg/l]	Dry season	1.4	1.5	1.3	1.4	**1.4**	1.7	1.8	1.8	1.9	1.9
	Normal Season	1.2	1.1	1.1	1.2	**1.4**	1.5	1.6	1.5	1.6	1.6
	Rainy season	1	1.1	1	1	**1.2**	1.4	1.5	1.5	1.5	1.4
Oil contents [mg/l]	Dry season	1.5	1.4	1.5	1.5	**1.5**	1.8	2.1	2.2	2.1	2
	Normal Season	1.7	1.6	1.7	1.6	**1.8**	2.2	2.5	2.6	2.5	2.4
	Rainy season	2	1.9	2.1	2	**2.3**	2.5	2.8	3	3.1	2.7

Date provided by the Office of Public Health, Wen County through Gansu Mingzhu Southern Hydropower Development Co. Ltd

In the dam reservoir, trout farming is now becoming popular. In addition to trout farming company brought in by Wen County, local immigrants also started their own farming business. The local immigrants told that farming without technical guidance from experts was very challenging, and they were not able to earn sufficient income. Because of this, currently there were too many immigrants starting the farming business, but if the farming business becomes more accessible, it may eventually start to affect quality of dam water.

The dam weir area passed the environment protection inspection[15] conducted by the designated government, and other areas such as turbine building, office, and residential areas were under inspection, expecting to receive their certification by the end of 2011.

3.4.2.2 Resettlement and Land Acquisition

The resettled households and land acquisition in this project increased from initial plans by 170 % and 280 % respectively. Reasons for increased number of resettled households were i) the area affected by water was widened under measures of the Resident Resettlement Plan, adding more households to the resettlement list, ii) from the time of planning to the actual resettlement, some dependents grew up and started their own households, increasing the household count. For the land increase, as described above, it was because the area to be non-submerged but affected was included to land acquisition.

[15] Environment protection inspection: designed to assess project's environment protection measures and its impacts on environment. This is done mainly by sections of the government in charge of environmental protection under the Regulations on Construction Projects for Environmental Protection set by the Chinese Government. Under the Regulation, an office at the province, city, or county level is required to submit a request for operation or test-operation of a project to its higher-level office, whereby that recipient higher-level office in charge of environmental protection assesses project's facilities and actions for environmental protection, by on-site visiting and document reviewing. The higher-level office then determines whether the construction project satisfies requirements for environmental protection.

Table 11 Resettlement and Land Acquisition: Plans and Results

Sub-project	Resettlement		Land Acquisition	
	Plan	Result	Plan	Result
Hanpingzui	Appr. 1,000 rsds 230 hhds	1,686 rsds 399 hhds	Appr. 90 ha	253 ha

Abbreviations: rsds = residents, hhds = households. Source: JICA documents and Wen County Immigration documents

Table 12 Reasons for Resettlement

	Area Total	Reason for Resettlement		
		Submerge Under Water	Additional Weir Area	Modified Route 212 Construction
Total	339 hhds 1,686 rsds	259 hhds 1,288 rsds	53 hhds 264 rsds	27 hhds 134 rsds
Yùlei Xiāng	335 hhds 1,655 rsds	255 hhds 1,267 rsds	53 hhds 264 rsds	27 hhds 134 rsds
Shàngdé Xiāng	4 hhds 21 rsds	4 hhds 21 rsds	—	—

Abbreviations: rsds = residents, hhds = households Source: Wen County Immigration documents

The resettlement plan was designed by Northwest Investigation Design and Research Institute. Gansu Mingzhu Southern Hydropower Development Co. Ltd. (Operator of Hanpingzui Hydropower Plant, (hereinafter referred to as the Mingzhu Southern Co.)) and Wen County People's Government signed an agreement on residents' resettlement and compensation in June 2004 along with the resettlement plan. The actual migration process was executed by the Wen County Immigration Office.

The migration process took following steps: 1) notification to residents through mailing and town meeting, 2) individual household visits to assess compensation contents and amounts, 3) notification of compensation policy, 4) contract signing with residents, 5) preparation of housing and infrastructure, 6) actual migration. From town meetings to actual migration took approximately two years. Compensation contents were determined by government regulations[16], and this amounted to 19 million yuan. The Immigration Office received the full payment from the Mingzhu Southern Co. by March 2005.

The destination of migration was one of the five areas selected by the Immigration Office(Case A) or an area found by the immigrants themselves(Case B). Housing was built and provided to immigrants moving for Case A, and fixed payment for housing construction was provided for Case B. One primary school, one hospital, four village clinics, two bridges, and three ferry piers were prepared in the resettlement areas. These expenses were paid with compensation from the power plant. Doctors at the village clinics were paid for by subside from the Immigration Office.

According to the Immigration Office, the average income of local households was 782 Yuan in 2005 before plant completion, and 1,141.92 Yuan in 2010. In contrast, the average income of immigrant households in 2010 was 1,465.80 Yuan higher than the local residents. This was associated with the 600-yuan compensation per person, which was given from the state starting in July 2006.

[16] "Regulations on Compensations for Land Requisition and Resettling Residents due to Large- or Middle-scale Hydropower Plant Construction" (State Council Notification 74, 1991) and "Notification on Tentative Action on Land Requisition and Resettlement due to Hydropower Plant Construction by the National Development Planning Committee" (No. 2623. 2002)

Housing and bridge the plant prepared for the immigrants

Interview on resident households were conducted. The two interviewed households were selected by the Office of Immigration. One household immigrated to one of the five selected areas while the other one found the new location on their own. Both households answered that after immigration their income increased and life standards in terms of electricity, water, and transportation improved. Quality of visited houses seemed descent and their lifestyles looked reasonably affluent.

The power plant opened up mountain slopes to provide farmlands to the immigrants. It also employed approximately 40 residents as casual workers. Furthermore, if a local resident satisfied designated technical standards, s/he was given a priority to be hired. These arrangements were made to provide employment opportunities to the immigrants in the local areas.

There were not enough farmlands since the land was made by opening narrow valley zones, leaving some farmers without alternative farmlands. These immigrated farmers, however, did not have feelings of insecurity as receiving original compensation and added government compensation and pension.

3.4.2.3 Other Local Benefits

The Chinese Government was implementing various programs to resolve disparities between rural areas and cities. As a part of this, electrification project was launched in Wen County and consequently electrification is steadily progressing (see Table 8). Before this project in 1998, only 30 % of villages in Wen County were electrified. The numbers of electrified communities or households were even uncounted. At the time of ex-post evaluation every village, community, and household was electrified with minor exceptions of distant households in deep mountains.

Table 13 Change in Electrified Rates in Wen County

	Electrified Villages	Electrified Communities	Electrified Households
1998	30 %	-	-
2010	100 %	100 %	98 %

Source: Results of Interview at Wen County Office of Electricity

Wen County People's Government noted that this project allowed securing sufficient electricity, and this freed the residents from "climbing up mountains to pick woods for warming bodies and cooking." The project provided sufficient electricity for local economic development from clean energy, and furthermore, promoted employment of the local residents, achieving remarkable improvements of life standards. Not only supplying electricity but also the infrastructure such as roads, irrigation, fish-farming was continuously developed, adding more contribution to income generation of local residents. At the ex-post evaluation, no negative impact was observed.

As for Impact, in light of the above, the project demonstrated positive impacts on environment, immigrants, local societies and residents.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance (Sub-rating ③)

Two organizations were involved in the Hanpingzui sub-project at the time of ex-post evaluation. They were the Mingzhu Southern Co. (Gansu Mingzhu Southern Hydropower Development Co. Ltd.) responsible for operation, management, maintenance, accounting, and human resource management of the plant, and Gansu Keyuan Electric Corporation (hereinafter referred to as the Keyuan Co.[17]) in charge of financial management and ranking-officer management.

The Mingzhu Southern Co. originally started as a project team for the plant construction within the Gansu Mingzhu Hydropower Development Co. Ltd. This company was the project executing agency at the time of ex-ante evaluation. The project team was seperated from this company at the time of plant completion to specialize itself in operation of the plant.

The Keyuan Co. was a corporation governed under the Gansu Province Electricity Corporation and was a main investor to the Mingzhu Southern Co.

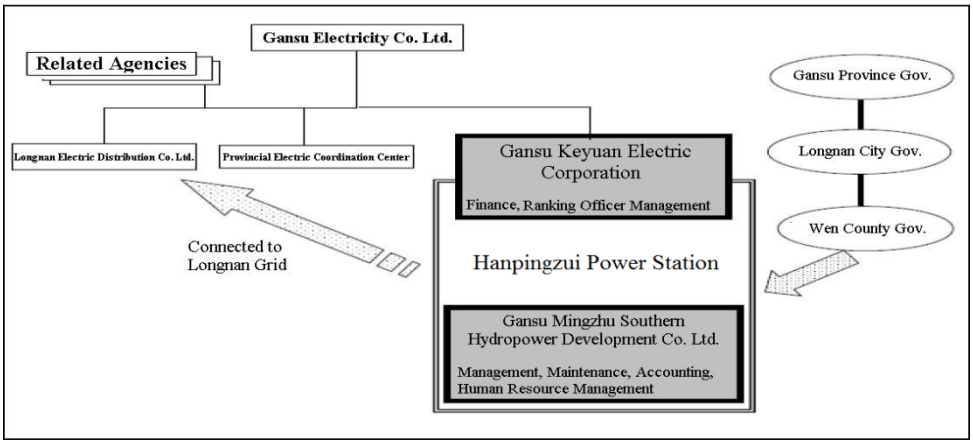


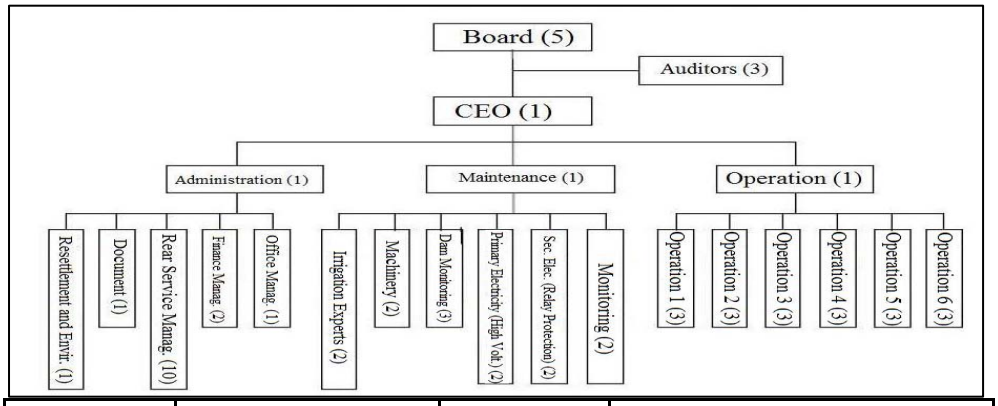
Figure 2. Organization Diagram related to the Hanpingzui Hydropower Plant.

The organizational structure of the Mingzhu Southern Co. maintained its form since the time of planning. (See Figure3 for details)

The mechanics of the Department of Operation and Department of Maintenance mostly possessed diplomas of the secondary-vocational level or higher. The average age was 26 and a male-female ratio was 3 to 1. The technological division consisted of Department of Operation and Department of Maintenance, and the administration division was solely of Department of Administration. Staff members were classified as upper managers, managers, or general staff members, and training was conducted to each class accordingly. The training cost was set to be 2 % of total salary payment, which increased each year.

[17] This company was renamed in 2009 from the Gansu Electricity Joint Corporation. Its areas of business expanded to various industries. Only three staff members in the company were in charge of Hanpingzui Hydropower Plant.

The People's Government of Wen County, where the Hanpingzui Hydropower Plant was located, holds responsibility to supervise operation and management of the power plant. The County government acknowledged that the Keyuan Co. was appropriately governing structural, financial, and technological aspects of the plant operation.



	Office	Personnel	Note
Department of Technology	Operation	19	3 personnel in one team, alternating.
	Inspection and Repair	14	
General Affairs Dep.	General Office	16	Incl. Officers for Resettlement and Environmental Protection
Higher Management		9	

Gansu Mingzhu Southern Hydropower Development Co. Ltd

Figure 3. Organizational Structure of the Mingzhu Southern Co.

3.5.2 Technical Aspects of Operation and Maintenance

The Director of the plant have served as a director of thermal, hydro, as well as wind power plants, well experienced as a director for altogether 28 years. The average age of all staff members including the mechanics was 28, with most of them having 5- to 10-year experience. At the ex-post evaluation, no issue concerning the technological aspect was recognized.

13 weeks training was conducted for newly employed person before assignment. Afterwards, training continued under the director's supervision. Various other training opportunities such as OJT in other plants and training held by the Provincial Electricity Corporation through director's personal connections were also available. A test was conducted each year to assess outcomes of training and skill development.

There was regular awarding to staff members for their outstanding performance or skill acquisition. This seemed to raise motivation of the staff members.

3.5.3 Financial Aspects of Operation and Maintenance

The financial conditions of the Mingzhu Southern Co., the operator of the plant, is shown in the below table. Revenue, net operating profit, and net profit all decreased in 2008, due to the damages to the facilities by the Sichuan Earthquake, and also in 2009, when repair was undergoing. It was in 2010 that the revenue largely recovered, and so did the profit, to the level before the earthquake.

Income by selling electricity, however, remained only 63 % of the target value. The output at the

sending end, known to affect the income, showed little difference to the target value. The selling price increased by 124 % from the ex-ante evaluation to the ex-post evaluation. The difference between the target and achieved values was presumably brought by the fact that selling price assigned by the Province Development Reformation Committee did not increase expectedly[18].

Table 14 Financial Details

	2005	2006	2007	2008	2009	2010
Gansu Mingzhu Southern Hydropower Development Co. Ltd.（Operating Hanpingzui Hydropower Plant）						
Revenue	21,468,535	50,006,567	58,354,909	53,555,357	58,820,690	66,000,167
Net Operating Profit	10,124,145	25,353,929	20,029,849	15,288,081	15,196,751	20,068,922
Net Profit	10,124,145	25,353,929	20,029,849	15,288,081	17,367,335	20,068,922
Fixed Assets	496,002,428	504,995,379	448,586,046	425,483,163	404,013,067	381,079,824
Current Assets	67,888,415	2,738,999	30,337,225	1,197,763	833,826	2,048,230
Stated Capital	10,800,000	10,800,000	10,800,000	10,800,000	10,800,000	10,800,000
Total Assets*1	696,379,956	777,430,238	643,011,416	591,409,917	562,156,411	528,783,154
Current Liabilities	206,972,501	187,688,854	59,377,754	32,720,389	53,101,204	26,594,200
Fixed Liabilities	379,634,816	454,634,816	447,128,533	407,128,533	342,128,533	312,128,533
Total Liabilities	586,607,317	642,323,671	506,506,287	439,848,922	395,229,737	338,709,293
Operation &Maintenance	2,020,000	1,870,000	3,610,000	4,100,005	7,780,000	16,040,000

Gansu Mingzhu Southern Hydropower Development Co. Ltd *1 Total Assets: In addition to the fixed and current assets, accounts receivable are included, and therefore, not necessarily equal to the sum of fixed and current assets.

In fact, both the power plant and the parent company were not concerned about this difference in the expected and actual incomes. The expected income was rather thought to be set inappropriately. The Hanpingzui Hydropower Plant was one of the plants[19] under coordination and management of the Province Electricity Coordination Center. The income was determined not by billing from the power plant, but by the buying price notified from the Electricity Coordination Center.

Table 15 Target and Result Incomes by Selling Electricity

Sub-project	Target* (million yuan)	Results (million yuan)						Average Achieving Ratio
		2005	2006	2007	2008	2009	2010	
Hanpingzui	104	21.5	50	58.35	53.55	58.82	66	49 %

*Target: Same as designated values. At the times of both the ex-ante evaluation and the mid-term evaluation (2005), designated values were applied. Date:Gansu Mingzhu Southern Hydropower Development Co. Ltd

Table 16 Transition of Selling Price of Electricity

(Unit: yuan / Kwh)

Time	At ex-ante Evaluation	Until 2005	After 2006
Unit Price	0.183	0.219	0.227

The increased price in 2006 is due to national policy to promote clean energy.

3.5.4 Current Status of Operation and Maintenance

The Sichuan Earthquake in 2008 caused the following damages, reducing the generation output by 30 million Kw.

[18] According to staff members of the power plant, the selling price of electricity generated by non-thermal means (i.e. hydro and wind) has been increased more than the thermally generated electricity has. This arrangement was to promote use of renewable energy in China. This price increase may not have been as much as it was expected.

[19] At the time of construction, this power plant would become a large-output plant in the region. Its generation conditions would be controlled in relation to the demand-supply balance of the whole province, as well as the grid.

i) The shaft of the second generator was displaced resulting in frequent horizontal fluctuation. Repaired in September 2008. Cost 450,000 yuan.

ii) Structural damage (partial) to the dam. Repaired in May 2009.

iii) Repairing generator building and administration building.

According to the plant director, damages had been controlled to the best ability possible, and were all in normal use at the time of ex-post evaluation. Except for cracks in the wall and 3- to 4-cm difference in level before the entrance, no sign of damage was seen. It was for 25 days that all the three generators had been forced to stop simultaneously, and the basic functions of generators recovered at the end of year 2009, three months after the earthquake. Complete recovery of all the plant facilities, including structural repair of the building, was achieved one year after the earthquake. After repair, the generators were in good operational conditions, and with increased volume of water current, the total electricity output increased after the earthquake. The repair cost was all paid for by the Mingzhu Southern Co.

Maintenance inspection was done as follows. Difference in the inspection frequencies to the plan was a result of on-site adjustment. Emergency manuals were also being implemented.

Preparation of spare parts for maintenance was properly managed. Imported parts, such as electric valves, magnetic switches, and monitoring panels, need long delivery periods to the inconveniently located plant, in addition to their large price fluctuations. Therefore, these parts were to be ordered to distributors well in advance. The present monitoring system could be used for a while. Renewing the entire system would be too expensive, and for the time being no immediate action was being planned.

Table 17 Comparison of Maintenance Frequency

Equipment/Facilities		Planned (2000)	At Ex-post Evaluation (2010)
Turbines Generators	Daily Inspection	When necessary	3 times / week
	Minor Repair	2 times / year	1 time / year
	Major Repair	1 time / year	1 time / year
Transformers	Inspection	1 time / 10 years	3 times / week
Dam	Inspection	1 time / 5 years	1 time / week

Gansu Mingzhu Southern Hydropower Development Co. Ltd

There were six teams, with three personnel in each team, in the Department of Operation in charge of generator operation. Based on director's experience they were arranged as follows; four teams take turns for operation, while one team was off duty and the last one was in training or research. There was one leader in each team responsible for staff management, through which maximum team performance was expectedly achieved. As at one point young staff members resigned consecutively from the plant, arrangements to improve employee retention were made. By these countermeasures cost of recruit and training due to staff resignation was well under control .

According to the Longnan Distribution Office, which was involved in operation of several small-scale hydropower plants in the Longnan Grid, the operational conditions of Hanpingzui Hydropower Plant were the best in the region. As far as the Distribution Office was aware, the Hanpingzui Hydropower Plant achieved good operational conditions by emphasizing operational safety and in so doing, maintenance of the equipment and facilities was frequently conducted and malfunctions were immediately repaired. Other

means included saving water resources by shortening maintenance periods and maximizing efficiency of hydro utilization by avoiding disposal of unexploited water. This was achieved through accurate prediction of waterfall amount aided by frequent communication with the weather section.

The parent Keyuan Co. was in possession of two hydropower businesses. Hanpingzui Hydropower Plant was more profitable, and the company was hopeful that this steady business condition would continue in future.

In light of the above, no major problems were observed in the financial, operational, or maintenance systems, therefore sustainability of the project effect was high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project's relevance was high because the project met 1) policies of the Chinese government to increase electricity supply capability and to promote clean energy development, 2) local area's needs for electricity, and 3) assistance agenda of Japan at the time. Effectiveness was also high from following observations; no operational problem was seen at the constructed power plant, and expected outcomes were mostly achieved. Efficiency was lower in comparison because the project budget and project duration turned out to be greater than planned. Structural, financial, and technological aspects of operation and maintenance were inferred to be appropriate.

In light of the above, this project was evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

1) Importance of Establishing Common Units and Measurements with the Partner Country

In this project, there were measures whose interpretation varied between the executing agency and JICA. For example, the executing agency and JICA had different definitions on the same term (i.e. Capacity factor). In another case, calculation was differently done from one year to another (i.e. net electric energy production), and in such cases confirmation and agreement required quite some time.

Such descriptions as "operation time (day)" and "suspension time (day)" were interpreted differently (sometimes these numbers indicated days, sometimes hours) even among the staff members of the power plant. Currently JICA has established common definitions of measurements and calculation formula with partner countries before signing, and recorded agreed definitions in the Record of Discussion or agreements. Lessons from this project also emphasized the importance of explicitly stating common measures,

definitions, and calculations between JICA and its partner countries.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs	**Foreign Currency** Package 1 Generators Generators 60 MW(20 MW×3), Transformers Package 2 Dam Construction Dam Structure (Reservoir capacity 51,000,000 m^3, 57 m height) and weir construction Package 3 Plant Construction Building and auxiliaries Package 4 Tunnel Construction Construction of intake tunnel and spillway tunnel, incl. steel structures. Package 5 Construction Materials **Local Currency** Tunnel Construction and Others Land consolidation of turbine building, drainage, main gate, down-stream bank consolidation Consulting Other Expenses Electric charges, etc.	**Foreign Currency** Package 1 Generators Generators 72 MW(20 MW×3), Transformers Package 2 Dam Construction Dam Structure (Reservoir capacity 51,000,000 m^3, 57 m height) and weir construction Package 3 Plant Construction Building and auxiliaries Package 4 Tunnel Construction Construction of intake tunnel and spillway tunnel, incl. steel structures. Package 5 Construction Materials **Local Currency** Tunnel Construction and Others Land consolidation of turbine building, drainage, main gate, down-stream bank consolidation Consulting Other Expenses Electric charges, etc.
2. Project Period	March 2001 to March 2004 (37 months)	March 2001 to September 2005 (55 months)
3. Project Cost Amount in foreign currency Amount in local currency Total Japanese ODA loan portion Exchange rate	Hanpingzui Sub-project 4,638 million yen 1,299 million yen(123.05 million yuan) 5,937 million yen 4,638 million yen 1 yuan = 13 yen (As of October 2000)	Hanpingzui Sub-project 4,638 million yen 2,844 million yen(198.05 million yuan) 7,482 million yen 4,638 million yen 1 yuan = 14.36 yen (Average from March 2001 to October 2007)