China

Hunan Yuanshui River Basin Hydropower Development Project

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1. Project Profile and Japanese ODA Loan

Map of project area

Wanmipo Hydropower Plant

1.1 Background:

Hunan Province is part of the Zhujiang Delta Economic Zone, where economic development has begun slightly behind the coastal regions of China. With demand for electric power in the province exceeding the volume which the province has traditionally been able to supply, it has been receiving a supply of electric power from surrounding provinces. Over a 10-year period from 1990 to 2000, energy demand of the province has risen at an annual average rate of 6.0%, rising from 22.7TWh to 40.6TWh. From 2000 to 2006 the growth rate increased to an annual average of 11.2%, standing at 76.9TWh in 2006. At the same time the river basin of the Yuanshui River, the third tributary of the Changjian River in Hunan, holds a wealth of water resources and the mountainous terrain is well suited for hydro-power generation. From the 1950s plans have been made to effectively utilize the water resources of the Yuanshui River basin. This project involved the construction of two hydroelectric power plants and is a part of the development of the Yuanshui River basin, planned as a project that will contribute to the economic development of the region by providing a stable supply of electric power.

1.2 Objective:

To enhance the balance of electric power demand and supply in the mid-western province of Hunan, which serves as a node between the coastal and inland regions of China and is thus strategically important for national economic development, by

constructing two hydroelectric power plants with an installed capacity of 225 MW and 240 MW, respectively, with concrete gravity dams in the Yuanshui River basin, thereby contributing to the economic development of the province and the wider mid-western part of China.

1.3 Borrower/Executing Agency:

The Government of the People's Republic of China/Ministry of Electric Power

1.4 Outline of Loan Agreement

Loan Amount / Disbursed Amount	17,664 million yen/8,857 million yen
Exchange of Notes / Loan Agreement	December 1998/December 1998
Terms and Conditions - Interest Rate - Repayment Period - Grace Period - Procurement	 0.75% 40 years 10 years Partially Untied (consulting service: bilaterally tied)
Final Disbursement Date	July 2006
Main Contractors (Over 1 billion yen)	ITOCHU Corporation (Japan), FUCHUNJIANG FUJI HYDROPOWER EQUIPMENT CO., LTD. (CHINA), JENKA INDUSTRIES LIMITED (Hong Kong), JSC ENERGOMACHEXPORT (Russia)
Consulting Services (Over 100 million yen)	J-POWER (Japan)
Feasibility Study (F/S), etc.	1998 Central Southern Geotechnical Design Institute

2. Evaluation Result (Rating: A)

2.1 Relevance (Rating: a)

2.1.1 Relevance at the time of appraisal

In the 9th National Five-Year Plan (1996-2000), the Chinese government

articulated that one of its policy targets was to maintain a high economic growth rate through development of core industries and infrastructure, with infrastructure development in the energy sector being of importance. In the 9th Five-Year Plan for the energy sector, as well as the construction of power plants according to demand, importance was also placed on the development of hydroelectric plants in areas that were suited to hydroelectric power generation.

The major development policy of the Chinese government set a target of increasing power generating capacity from an annual average of 15,000MW during the 9th National Five-Year Plan (1996-2000) to an annual average of 18,000MW during the 10th National Five-Year Plan (2001-2005). Other targets included raising the proportion of clean energy in the primary energy mix, with a view to raising the proportion of hydroelectric power generating capacity to 30% of total capacity over the long term. This demonstrates the high priority placed on power plants and hydroelectric power in particular.

At the time of appraisal, Hunan Province purchased power from other neighboring provinces, but still could not fulfill demand. This project was devised to be implemented as a multi-purpose comprehensive hydropower generation development plan, using the wealth of potential hydro-power resources in the Yuanshui River and as part of the Yuanshui River basin development project, which targeted to construct nine dams by 2010. It was deemed that, by constructing two hydroelectric power plants as part of the abovementioned plan, this project would ease power supply and demand issues in Hunan province and contribute to regional economic development, and was given a high degree of priority.

2.1.2 Relevance at the time of evaluation

The 11th National Five-Year Plan (2006-2010) set the target of actively developing the energy industry and electric power, including the promotion of hydroelectric development. The development of electric power sector infrastructure therefore continued to be accorded high importance.

The main policy in the 11th Five-Year Plan (2006-2010) for the power sector of Hunan Province was to support national energy development, and promote the construction of power plants and a power network in the Province that was in accordance with power demand and also mindful of environmental aspects. A target was set of achieving a comprehensive power generating capacity of 11,040MW by 2010 and infrastructure development in the power sector in Hunan continued to be given high importance.

The power demand of Hunan Province rose by 14% over the one year from 2005 to 2006 and is expected to increase more rapidly due to future economic development. The Yuanshui River Basin Development Project ultimately aims to construct 15 dams, and Hunan Wuling Hydropower Development Co., Ltd, the executing agency for this project, is currently involved in the construction or the operation and maintenance of seven dams (five are completed, two are still under construction). Hydroelectric power generation in the Yuanshui River basin accounts for half of Hunan's power generation capacity and at the time of evaluation this project still had a high degree of importance.

Accordingly, at both the time of appraisal and ex-post evaluation, the implementation of this project was found to be in accordance with the targets of national plans, etc., and was deemed therefore to be of high relevance.

2.2 Efficiency (Rating: b)

2.2.1 Outputs

Under this project two hydroelectric power plants with capacities of 225MW and 240MW and their ancillary facilities were constructed largely according to plan. Table 1 shows a comparison between the planned and actual outputs of this project.

Table 1 Planned and Actual Project Outputs

	Hongjiang Power Plant		Wanmipo Power Plant	
	Plan	Actual	Plan	Actual
Length and height of dam	456.5m ×56.0m	As planned	265.0m ×64.5m	As planned
Water reserve capacity	320 million m^3	As planned	378 million m^3	As planned
Generators	45MW×5	47MW×6	80MW×3	As planned
Transformer substations	100MVA×2, 50MVA×1	100MVA×3	100MVA×3	As planned
Ship passage facility	Double ship lock system	As planned	Ship lift system	Not installed

At Hongjiang Power Plant, with the aim of increasing power generating capacity and responding to maximum power demand, a sixth generator was purchased in local currency in China and therefore the number of generators was increased by one over the original plan. The configuration of the transformer substations was also changed in line with the increased number of generators. At Wanmipo Power Plant, a ship passage facility was not installed, because of a declining demand for ship transportation (due to the decline in the forestry industry and the increasing preference for road transportation) and also because of a plan to build another dam without ship passage facility between Wanmipo Power Plant and a power plant located downstream of the Yuanshui River. A ship passage facility at Wanmipo Power Plant therefore also became unnecessary.

2.2.2 Project Period

This project was planned to be implemented over a 48-month period, from December 1998 to December 2002; however, in fact it required 69 months, from December 1998 to August 2004, running 21 months over the planned period (144% of the plan). The reason for this delay was that when the project was originally planned in 1997 there was a shortfall of electric power supply in Hunan, but following the conclusion of the loan agreement, and while the project was waiting for construction approval, the National Development and Reform Commission put a nationwide freeze on approval of power plant construction for reasons of adjusting the national power supply-demand balance. It was due to this freeze that the project needed 18 months before it obtained approval in June 2000. At the same time, bidding procedures for contracts also took time and actual construction did not start until May 2001. However, once construction began the project was implemented more or less in accordance with the original plan.

As the freeze on construction approval can be viewed as an external factor beyond the responsibility of the executing agency and contractors, in the ex-post evaluation, the delay caused by the freeze on construction approval has been excluded, and the exceeded period is therefore three months (106% of the plan).

2.2.3 Project Cost

In contrast to the initially planned project cost of 71,155 million yen (of which Japanese ODA loan was 17,664 million yen), the actual cost amounted to 47,697 million yen (of which Japanese ODA loan was 8,857 million yen), equivalent to 67% of the initial plan. There are various factors that contributed to this lower figure, including the following: (1) It was initially planned to purchase equipment

(trucks, etc.) by which to transport large-scale machinery, but the construction company already possessed this equipment so purchase was not required; (2) as a result of international bidding, it was possible to realize efficient procurement; (3) construction costs were reduced due to improved construction plans and designs; (4) construction time was shortened through strict construction management; and (5) the decision not to install a ship passage facility at Wanmipo Power Plant.

Although the project cost was considerably below the initial plan, the project period slightly exceeded the plan and therefore the efficiency of this project is judged to be moderate.

2.3 Effectiveness (Rating: a)

A comparison of the planned and actual figures for the operation and effect indicators, a verification of the qualitative effects, and a recalculation of the internal rate of return were carried out. As a result of the analysis of these factors, it was judged that the effects had been realized by the implementation of this project largely as planned, and that the effectiveness of the project was therefore high. The analyses of each item are shown below.

2.3.1 Operational status of hydroelectric power plants

Using the operation and effect indicators of hydroelectric power plants, the planned and actual values pertaining to the facilities at Hongjiang and Wanmipo Hydropower Plants were compared in Table 2.

Table 2: Planned and Actual Figures for Operation and Effect Indicators of Hongjiang and Wanmipo Hydropower Plants

Indicators		Unit	Target Figures at Time of Completion	2004		2005		2006		2007	
				Hongjiang	Wanmipo	Hongjiang	Wanmipo	Hongjiang	Wanmipo	Hongjiang	Wanmipo
Maximum Output		(MW)	Hongjiang: 225.0 Wanmipo: 240.0	225.0	240.0	270.0	240.0	270.0	240.0	270.0	240.0
Net Electric Energy Production		(GWh/year)	Hongjiang: 970.0 Wanmipo: 792.0	795.4	548.3	669.4	558.8	720.7	414.2	852.7	721.8
Capacity Factor		(%)	Hongjiang: 49.2 Wanmipo: 37.7	40.73	39.97	31.57	26.78	30.89	19.88	41.10	37.70
Hydro Utilization Factor		(%)	Hongjiang: 80.0 Wanmipo: 85.3	95.98	97.81	92.02	95.20	98.10	97.28	99.23	99.44
Annual Total Volume of Inflow to the Reservoir		(100 million m3/year)	Hongjiang: 222.0 Wanmipo: 94.3	212.2	98.3	148.1	73.2	137.5	54.3	162.1	105.5
Planned Outage Hours		(Hours/Year)	N/A	2187.0	258.0	2333.0	1337.0	4254.0	843.0	4356.5	956.8
Unplanned Outage Hours	Machine Trouble	(Hours/Year)	N/A	71.9	27.9	3.8	0.0	0.0	0.0	0.0	0.0
	Human Error	(Hours/Year)	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Natural Disasters, etc	(Hours/Year)	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Hunan Wuling Hydropower Development Co., Ltd

Note: Capacity Factor = (net electric energy production) / (maximum output x number of hours a year) x 100
Hydro Utilization Factor = (net electric energy production) / (annual generating capacity in the year in question) x 100
Auxiliary Power Ratio = (volume of electric power consumption within a plant a year) / (net electric energy production) x 100

The maximum output of Hongjiang Power Plant is greater than planned as an additional generator was incorporated. In 2005 and 2006 rainfall levels were lower than average and the annual total volume of inflow to the reservoir was therefore low, which resulted in net electric energy production and the capacity factor not reaching target levels, but in 2007, when rains returned to normal levels the power plants achieved results that were close to the target. In addition, the hydro utilization factor is greater than 90%, which is higher than planned, indicating that the plants are being operated at a high level of efficiency.

At the time of the start of operations at the power plants (2004), although there was an unplanned outage due to machine trouble, the repairs to the faulty sections were completed, after which there have not been any outages due to machine trouble. In addition, there have not been any outages due to human error or flooding and inspection and operation and maintenance systems are in place. The plants are operating at a higher level than national average.

2.3.2 Qualitative effect

Through the stable provision of electric power, this project has contributed to improving the living environment and also to improving the power supply to industry and agriculture in the vicinity. In addition, by controlling water levels, the project has also contributed to flood prevention in areas downstream of the dams.

In 2004, a flood that occurs once every fifty years occurred in the upstream of the Hongjiang Power Plant, but thanks to the existence of the dam, those villages (towns and residents) downstream were able to avoid flooding. In addition, in Hongjiang it became possible for large-scale vessels to pass the reservoir, which has contributed to economic development in both up and downstream areas. Although a ship passage facility was not incorporated at the Wanmipo Power Plant, improvement of ship passage capabilities has contributed to an increase in river transportation capabilities upstream.

2.3.3 Recalculating the internal rate of return

2.3.3.1 Financial internal rate of return (FIRR)

The financial internal rate of return (FIRR) of Hongjiang Power Plant was recalculated based on a project life of 30 years, with income from power sales set as benefit, and initial investment and operation and maintenance cost set as costs. The result was calculated at 7.6%, down from 11.0% at the time of appraisal. The result of recalculation for Wanmipo Power Plant under the same set of conditions was calculated at 2.8%, considerably less than 10.6% calculated at the time of appraisal.

Unit prices of electric power sales are renewed annually. These are set by the government and cannot be adjusted by the executing agency. In particular, in recent surging coal prices, Hunan Province has adopted a policy to ease power prices across the province by keeping power procurement prices from hydroelectric power plants at a low level to offset cost increases at thermal power plants. Another reason was the drought in 2005 and 2006, which brought water flow volume down to around 66.5% of the annual average, meaning that power sales volume was also low. However, in 2007 when rainfall returned to near-average levels, income increased. Hunan Wuling Hydropower Development Co., Ltd is a private sector company and active to rationalize management, including reductions in operation and maintenance costs, and make efforts to record a profit. The plants therefore have a high potential for increased profitability in the future.

2.3.3.2 Economic internal rate of return (EIRR)

In order to estimate indirect benefits brought about by the project, EIRR was calculated using the following two types of benefits: 1) The benefit accrued through the cost difference from building a thermal power plant on a similar scale; and 2) willingness to pay (WTP) for the reductions in power outages and the

reduction in atmospheric pollution by not building a thermal power plant, from which the benefits of actual improvements in power outages and atmospheric pollution reduction are estimated. The result of 1) above showed that the EIRR for Hongjiang Power Plant was 12.8% (12.6% at the time of appraisal) and for Wanmipo it was 33.2% (15.6% at the time of appraisal). Using this method, although actual income is reduced, EIRR exceeded the initially planned figure due to the fact that: (1) construction costs were considerably reduced, and (2) the benefit of hydroelectric power generation has increased due to coal price increases. In particular, the reason why the EIRR for Wanmipo Power Plant is considerably higher is largely due to the significant reduction in construction expenses achieved through the decision not to install a ship passage facility. The result of 2) above showed that the EIRR for Hongjiang and Wanmipo were 9.5% and 10.3% respectively. The beneficiary survey of the project needed for WTP calculation was implemented on 297 residents (194 valid responses received) in the city of Changsha, which lies in the region that benefited from the project. However, the power generated by this project is transmitted widely across the whole of Hunan Province and the scope of benefit was therefore set as the whole of Hunan Province for the purpose of EIRR estimates. The results in both cases show that the project can be evaluated as having produced significant benefit.

Consequently, it is reasonable to conclude that this project has realized effects as planned and its effectiveness is high.

2.4 Impact

2.4.1 Benefits to target region and residents

2.4.1.1 Increased tax revenues in vicinity of hydroelectric power plants

Due to tax payments by the power plants regional tax revenues have increased. The amount of taxes paid by Hongjiang Power Plant to Hongjiang Regional Tax Bureau has increased from 6.6 million yuan (2003) to 36.1 million yuan (2007). In addition, in Baojing County, where Wanmipo Power Plant is located, the only industry prior to construction of the power plant was agriculture, and the county's tax revenues were the lowest of the nine counties in Hunan Province, but since the construction of the power plant the county's position in tax revenues has improved to third among the nine counties and from 2004 to 2006 it won a special prize from the provincial government as a model county. Baojing County's revenues have increased from 60 million yuan (2003) to 173 million yuan (2007) and 14.4 million yuan of this figure (in 2007) was accounted for by tax payments from Wanmipo Power Plant. Both power plants have made a significant contribution to

increasing regional tax revenues.

2.4.1.2 Increased employment opportunities and economic development in vicinity of hydroelectric power plants

Due to improved transport networks and increased awareness about the power plants, investment in the region has increased, with workplaces in the vicinity of Hongjiang Power Plant increasing by more than 100, thus boosting employment opportunities. However, although more than 10 new companies in the vicinity of Wanmipo Power Plant have created an industrial zone, employment opportunities in the region are still not enough. Thus, some people have had to engage in migrant labor. In villages to which residents were resettled due to the construction of the dams, resettled residents' management centers run by the government have been established, and provide work skills training and training for migrant laborers.

The reservoirs at both power plants have provided benefits through the development of aquaculture and tourism, and increased employment opportunities and economic development have been witnessed in the vicinity of the dams. Many of the residents who were resettled due to dam construction, have changed their jobs, moving from agriculture to fishing, and also to running a restaurant, aquaculture, bamboo processing and other industries. Due to this job change, the income of many of the residents has risen. A system is in place to ensure that resettled residents receive priority in gaining employment in jobs that enjoy high sales, such as aquaculture, and the income of resettled residents is comparatively higher than those of residents who were not resettled.

Table 3: Change in Levels of Income Before and After the Project Implementation

(median, unit: yuan)

	Hongjiang		Wanmipo	
	Relocated Residents	Non-Relocated Residents	Relocated Residents	Non-Relocated Residents
Before Relocation	7,000		3,000	
After Relocation(2007)	10,000	8,000	7,500	4,000

(The number of samples: Hongjiang: 13 relocated and 4 non-relocated persons, Wanmipo: 9 relocated and 11 non-relocated persons)

2.4.2 Impact on the natural environment

During the construction of the power plants an environment monitoring station in each locality implemented environmental monitoring to gauge the impact on people; water, air and noise; and sediment volume in the water. Following construction of the power plants the Hunan Environmental Protection Bureau

Evaluation Center and the Hunan Ground Erosion Maintenance and Monitoring Station have implemented regular monitoring of water quality, biological resources, land use and ground erosion. At Hongjiang Power Plant water quality is tested six times a year (twice each during the flood, standard and dry seasons), and sediment is tested once a year when water levels are low. At Wanmipo Power Plant water quality is tested once each during the flood, standard and dry seasons, and sediment is tested once each during the flood and dry seasons. No particular problems have been detected at Hongjiang Power Plant. At Wanmipo Power Plant tests at the river mouth have shown levels of manganese and zinc above standard values in times of flood, and similar levels of manganese, zinc and mercury when water levels are low. However, as there are no records for water quality prior to the construction of the dam it is not clear whether these figures are due to the construction of the dam. During seasons when water volume is at standard levels the indicators for all these elements are within prescribed standard.

2.4.3 Resettlement of residents and acquisition of land

This project required the acquisition of 693ha of land, resulting in the resettlement of 21,456 residents. Although there was a drop from the anticipated number of 26,760 at the time of appraisal to 21,456, the costs for compensating residents increased due to changes in national standards for resettlement compensation and the amount paid for land acquisition and compensation exceeded the planned amount. In addition, a consideration to minimize the number of residents to be resettled, including construction of levees in order not to relocate those who living in ares protected by levees, also led to an increase of compensation expenses, as the cost for building levees was part of compensation budget.

Table 4: Status of Resident Resettlement and Land Acquisition

	At time of appraisal			After project implementation		
	Hongjiang	Wanmipo	Total	Hongjiang	Wanmipo	Total
Number of resettled residents	9,179	17,581	26,760	8,747	12,709	21,456
Area of land acquired (ha)	344	441	785	313	380	693
Area of buildings acquired (thousand ㎡)	293	554	847	258	296	554
Land acquisition and compensation costs (ten thousand yuan)	194	350	544	310	403	713

(Source: Hunan Wuling Hydropower Development Co., Ltd)

In the area for resettlement a variety of infrastructure was developed, including schools, roads and water and sewerage facilities. A support center was established to help improve the living standards of those residing in the vicinity of the dam. The center gives job and lifestyle advice to the residents in the vicinity of the dam and also provides training for migrant workers. In addition, in the area of Hongjiang Power Plant a bamboo processing training center has been created, utilizing bamboo resources in the region.

Questionnaire-survey targeting resettled residents shows that while prior to resettlement residents in both Hongjiang and Wanmipo used well and river water for drinking and daily needs, almost all homes are now connected to mains water as a water facility has now been constructed in the resettled area. In addition, in terms of possession of household goods and appliances, the living standard of resettled residents has improved after resettlement (Table 5). In particular, a high proportion of households now have mains water, washing machines and refrigerators, etc., and the number of households owning other goods and appliances has also increased. Cooking methods have also changed. Prior to resettlement the main source of fuel was wood and coal, and after resettlement improvements have been achieved in the increased use of gas and electricity. Even if improvements in living standards have been brought about by economic development across China, it is clear that in both areas the living standards of the resettled residents have been given an additional boost due to resettlement.

Table5: Changes in Living Standards of Resettled Residents

		Hongjiang		Wanmipo	
		Before Relocation	After Relocation	Before Relocation	After Relocation
Household goods and appliances (multiple answers)	No. of valid responses	13	13	8	9
	Toilet	11	12	7	9
	Electricity	11	11	8	9
	Mains Water	2	10	1	9
	Color TV	9	12	7	8
	Washing Machine	9	11	1	7
	Refrigerator	6	11	0	3
	Air Conditioner	0	3	0	1
	Motorbike	2	5	0	2
	Family Car	0	1	1	1
Drinking water resources (multiple answers)	No. of valid responses	13	13	8	8
	Well	8	4	3	0
	River	0	0	5	0
	Spring Water	5	5	1	2
	Mains Water	1	13	0	7
Cooking methods (multiple answers)	No. of valid responses	13	13	9	9
	Wood	11	9	9	4
	Coal	9	8	1	2
	Oil	0	0	0	1
	Gas	2	4	1	4
	Electricity	3	8	0	0

(Questionnaire were distributed to relocated residents, 13 in Hongjiang and 9 in Wanmipo.)

In Hongjiang there was previously a local bamboo processing industry, and due to economic development in China as a whole demand for bamboo materials has expanded rapidly. Resettled residents who have transferred from agriculture-based work to the bamboo processing industry, have achieved better incomes. It is for these reasons that there is little dissatisfaction about the resettlement among residents.

However, in Wanmipo although the resettled residents were financially compensated under a national scheme for the agricultural land that was acquired for the project, many of them have been forced to travel long distances in search of work as migrant laborers because there was insufficient employment in the village. It is for this reason that although income has increased from before resettlement, there is still dissatisfaction among residents concerning the resettlement.

2.5 Sustainability (Rating: a)

There were no problems with the capabilities and operation and maintenance system of the executing agency for this project and it is evaluated that a high level of sustainability can be foreseen. Below is an analysis of the operation and maintenance system of the executing agency, its financial status and operation and maintenance status.

2.5.1 Executing agency

2.5.1.1 Operation and maintenance system

Hongjiang Power Plant is operated and maintained by Yuanshi Hydropower Development Co., Ltd, a subsidiary of Hunan Wuling Hydropower Development Co., Ltd, and Wanmipo Power Plant is operated and maintained by Wuling Hydropower Development Co., Ltd. Each company has a production operations division which is engaged in operation and maintenance work. As can be seen in Chart 2, each production operations division comprises dam regulation, sales, safety production and information management divisions, responsible for various aspects of operation and maintenance at the plants.

Chart 1: Organization of Hunan Wuling Hydropower Development Co., Ltd

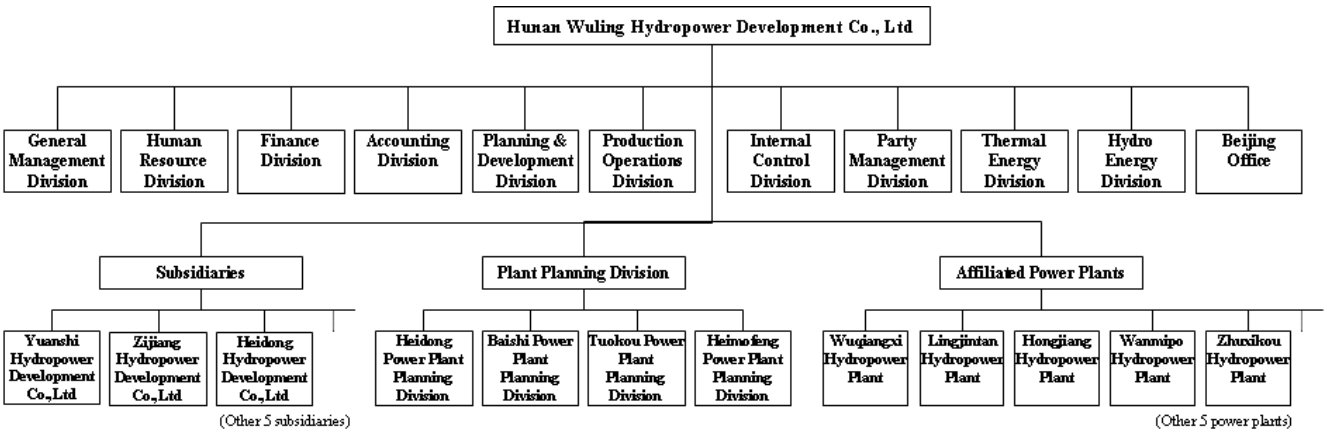
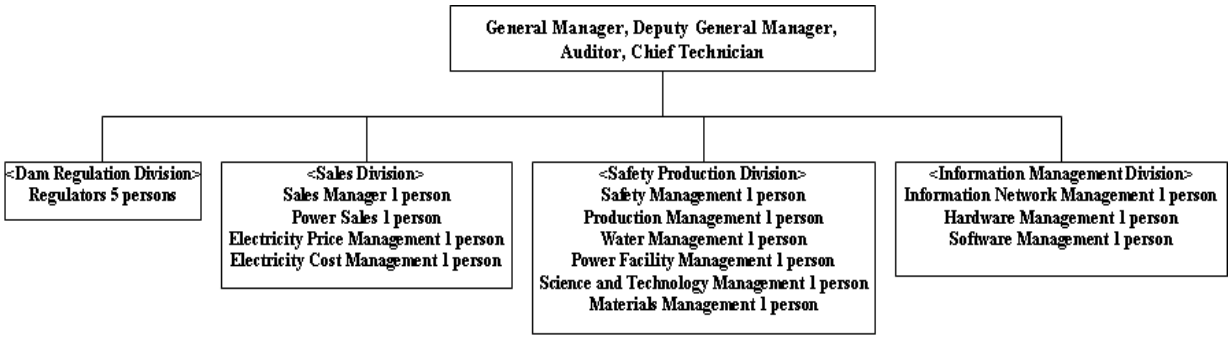


Chart 2: Management structure of production operations division



2.5.1.2 Technical capacity

Both power plants have a central control room that is in operation 24 hours a day. Daily equipment and facility inspections are carried out and once a year a large-scale maintenance program is implemented. In times of flood an observer is stationed at each spillway to implement inspection.

A short period of training is implemented by China Grid and each department of both power plants also implements training. A training manual is also available. In addition, a qualification system has been developed and unless staff members pass a technical evaluation they are not provided with qualification certification, meaning that they are unable to engage in work. Each staff member engages in work upon receiving their qualification certificate. The systems and facilities have been developed for the inspection manual, training, and qualification acquisition, and there are no technical problems in operation and maintenance.

2.5.1.3 Financial status

More than 95% of the shares of Yuanshi Hydropower Development Co., Ltd are held by Hunan Wuling Hydropower Development Co., Ltd, and in actual terms finances are managed by Wuling. The financial management of Wanmipo Power Plant is also conducted by Wuling Hydropower Development Co., Ltd. In 2005 and 2006 due to a lack of water caused by drought, the volume of electricity generated was approximately 50 to 70% of the planned figure, but in 2007, when rainfall reached average levels, power generated reached planned levels and profits are accordingly expected to increase. In addition from 2005 to 2006 other dam construction projects were being implemented and this increased investment costs. Currently there are six hydroelectric power plants under construction simultaneously and this is creating significant liabilities, but once the construction of these plants is completed it is expected that financial status will stabilize.

Operation and maintenance costs are declining year by year at both plants, but as it is the case that operation and maintenance costs secured is in proportion to income from electricity sales, there are no particular problems foreseen as operation and maintenance costs will increase in accordance with profit increase in the future.

Table 6: Financial status of Wuling Hydropower Development Co., Ltd, Hongjiang Power Plant and Wanmipo Power Plant

		2004	2005	2006
Liquid assets (10,000 yuan)		195,204	116,035	49,827
Fixed assets (10,000 yuan)		1,472,929	1,762,161	2,167,336
Total assets (10,000 yuan)		1,674,836	1,888,903	2,304,442
Liquid liabilities (10,000 yuan)		78,156	164,925	224,531
Total liabilities (10,000 yuan)		1,382,387	1,550,655	1,919,875
Equity capital (10,000 yuan)		292,449	338,248	384,567
Sales (10,000 yuan)		191,713	181,314	183,364
Net profit (10,000 yuan)		21,619	32,696	37,347
Liquidity ratio (%)		250%	70%	22%
Net profit to sales (%)		11%	18%	20%
Total return on assets (%)		1%	2%	2%
Hongjiang Power Plant	Operation and maintenance costs (10,000 yuan)	3,126	2,938	1,949
	Income from power sales (10,000 yuan)	79,538	66,932	72,068
Wanmipo Power Plant	Operation and maintenance costs (10,000 yuan)	2,108	2,224	1,470
	Income from power sales (10,000 yuan)	54,829	56,312	41,419

(Source: Wuling Hydropower Development Co., Ltd)

2.5.2 Operation and maintenance status

Daily inspections are implemented at both power plants. Inspectors check facilities three times daily. Large-scale inspections and repairs are implemented once every few years by the Wuling Power Operations Company (an independent company that is a subsidiary of Wuling Hydropower Development Co., Ltd and an amalgamated company). General disassembly and inspections are implemented every six months at the plants. In addition, at Hongjiang Power Plant the safety management of ship passage and waterways are commissioned to a local company, and there are no problems with the status of operation and maintenance.

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

As the project period was slightly delayed, its efficiency has been evaluated as moderate, but in terms of relevance, effectiveness, and sustainability, in all cases there are no problems and the evaluation for the project as a whole is extremely high.

3.2 Lessons learned

In the case of resident resettlement, if there are no major industries in the resettlement area, then it is likely that resettled residents will have difficulty in rebuilding their lives. In such cases, in the process of compiling and appraising a resettlement plan, one solution would be to first provide vocational training to residents who need to relocate and provide support for their resettlement to industrial areas.[1]

3.3 Recommendations

To the executing agency and JBIC:

As the construction of hydroelectric power plants brings about long-term changes to the economic and social environment for resettled residents it is recommended to continue to make evaluations from a long-term perspective.

[1] Although not applicable to this project, the current JICA/JBIC "Guidelines for Environmental and Social Considerations," formulated in April 2002, stipulates that in the case of involuntary resettlement, "Project proponents must make efforts to enable people affected by projects to improve their standard of living…or at least to restore them to pre-project levels." Currently in conducting appraisal, the question of whether or not assistance would be provided to restore standards of living as described above is confirmed.

Comparison of Original and Actual Scope

Items	Plan	Actual
(1) Output		
1) Hongjiang Power Plant		
a) Hydroelectric power generation facilities	Height 56m, Total reserve capacity 320 million m^3	As planned
・ Gravitation-style concrete dam	Total output 225MW (45MW×5)	Total output 284.4MW (47.4 MW×6)
・ Generators		
b) Ship passage facility	Double ship lock system (Maximum vessel size: 100t)	As planned
2) Wanmipo Power Plant		
a) Hydroelectric power generation facilities	Height 64.5m, Total reserve capacity 380 million m^3	As planned
・ Gravitation-style concrete dam	Total output 240MW (80MW×3)	As planned
・ Generators		
b) Ship passage facility	Ship lift system (Maximum vessel size: 50t)	Not installed
Consulting service	45M/M	47M/M
(2) Period	December 1998 to December 2002 (48 months)	December 1998 to August 2004 (69 months) Waiting for construction approval: December 1998 to May 2000
(3) Project cost		
Foreign currency	17,664 million yen	8,857 million yen
Local currency	53,491 million yen (3,343 million yuan)	38,840 million yen (2,770 million yuan)
Total	71,155 million yen	47,697 million yen
ODA loan portion	17,664 million yen	8,857 million yen

Exchange rate	1 yuan = 16.0 yen (Time of appraisal: March 1998)	1 yuan = 14.0 yen (Weighted average rate from 1998 to 2004)