Myanmar

Nyauggyat (Kinda) Dam Multipurpose Project

Report Date: September 2002

Field Survey: September 2001

1. Project Profile and Japan's ODA Loan

Site Map：Southeast of Mandalay

Site Photo：Irrigated Area at Kume Town 26km from Dam

1.1 Background

In Myanmar, agriculture is the most important industry, and the Government of Myanmar has made various efforts to improve it. As much as 57% of total public investment in agriculture has been allocated to irrigation projects. Moreover, diffusion and the consumption of electricity in Myanmar remains extremely low, and further efforts should be made to increase the production of electric energy. This irrigation project, the largest in Myanmar, was therefore given high priority by the government. It is expected to play an important role in modernizing agriculture and in increasing the production of electricity.

1.2 Objectives

To increase agricultural production and electricity production by providing irrigation and flood control for five areas of farmland covering 81,500 hectares, and to provide a hydropower station of 56MW capacity, followed by the construction of a multipurpose dam in Panlaung valley near Mandalay, a dry region at the center of Myanmar.

1.3 Project Scope

The scope of the whole project included the multipurpose dam, hydropower station, irrigation and drainage facilities, agriculture support and agriculture mechanization. The whole project was implemented with financing from Japan, IDA, Germany, Norway and Myanmar. The Japanese ODA loan covered the foreign currency portion for (a) irrigation and drainage facilities, (b) agriculture support, and (c) agriculture mechanization. The irrigated area of this project lies approximately 65km due south of Mandalay. Annual rainfall in the area is approximately 810mm, most of which is concentrated in the rainy season.

1.4 Borrower/Executing Agency

Borrower: Government of Myanmar

Executing Agency:

- Irrigation Department, Ministry of Agriculture & Forestry
- Agriculture Corporation, Ministry of Agriculture & Forestry
- Agriculture Mechanization Department, Ministry of Agriculture & Forestry

1.5 Outline of Loan Agreement

Loan Amount	3,600 million yen
Loan Disbursed Amount	3,081 million yen
Exchange of Notes	October 1980
Loan Agreement	January 1981
Terms and Conditions	
Interest Rate	2.25% p.a.
Repayment Period (Grace Period)	30 years (10 years)
Procurement	General Untied
Final Disbursement Date	January 1986

2. Results and Evaluation

2.1 Relevance

In Myanmar, agriculture is the most important industry, and the Government of Myanmar has attached a great deal of importance to irrigation projects since Myanmar is a country with tremendous potential for agricultural production in terms of land, water and human resources.
The total area of irrigated land in Myanmar is expanding, with 7% annual growth in the past ten years. The agricultural sector in Myanmar occupies a dominant position in the development of the national economy and the contribution of the agriculture sector to GDP of Myanmar is in the range of 35-40%.

In Myanmar, the availability and use of electricity were low. Development of power resources and preparation of a complete power distribution network were very important tasks for improving public welfare and promoting industrial development. Both the generation and consumption of electric power was growing sharply; average growth from 1974 to 1984 exceeded 10%. Electric power consumption has been increasing 8% annually in the past five years.

The Ministry of Agriculture & Irrigation (MAI) has stated that as “Myanmar is a country with tremendous potential in land, water and human resources for crop production, the agriculture sector will remain as an integral element in accelerating the economic growth of the country” The Government still places priority on increasing agricultural production by means of irrigation and increasing of electric power production. Therefore, it can be concluded that the project is relevant at present.

2.2 Efficiency

(2.2.1) Project Scope

The actual scope was the same as originally planned.

(2.2.2) Implementation Schedule

The dam was completed ahead of schedule, and the hydropower station commenced supplying energy to the National Power Grid on schedule. The implementation of the irrigation and drainage facilities of the project, however, took about ten years, compared to the planned six years. The delay in the completion of facilities was mainly due to national shortages of construction materials, diesel and lubricants, and political unrest during the latter part of the project implementation period.

(2.2.3) Project Cost

The actual whole project cost of the foreign currency portion was within budget, but the actual cost of the local currency portion overran due to the delay in the completion of irrigation and drainage facilities, as shown in Table 1. The amount of Japan's ODA loan disbursed was also within budget, as detailed in Table 2.

Table 1: Comparison of Original and Actual Project Cost

Unit: Million US Dollars

Items	Original Cost			Actual Cost		
	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total
Multipurpose Dam	77.0	24.5	101.5	69.69	39.71	109.40
Hydropower Station	45.0	18.0	63.0	48.58	17.30	65.88
Irrigation and Drainage Facilities	24.6	30.4	55.0	19.18	52.34	71.52
Agriculture Support	2.0	2.2	4.2	0.26	1.45	1.71
Agriculture Mechanization	1.5	0.9	2.4	0.69	0.63	1.32
Valley Survey & Detail Engineering	6.4	0.8	7.2	7.00	0.80	7.80
Utilization of Underground Water	1.5	0.2	1.7	1.20	0.20	1.40
Total	158.0	77.0	235.0	146.60	112.43	259.03

Source: Hearing from Irrigation Department (ID) at the time of post-evaluation.

Table 2: Comparison of Original and Actual Project Cost of Japanese ODA Loan Portion

Unit: Million

	Original		Actual	
	Yen	(US$)	Yen	US$
Irrigation and Drainage Facilities	3,240	(13.5)	2877.70	11.99
Agriculture Support	24	(0.1)	13.56	0.06
Agriculture Mechanization	336	(1.4)	189.74	0.79
Total	3,600	(15.0)	3,081	12.84

Note: Exchange rate of 240 yen = 1 US$ was used.

Source: Hearing from Irrigation Department (ID) at the time of post-evaluation.

2.3 Effectiveness

(2.3.1) Irrigation, Drainage and Flood Protection Facilities

The existing irrigation system of about 35,600 hectares was rehabilitated to assure the adequate system transmission of water and measurement of irrigation water. In addition, a new system for 45,900 hectares was constructed, including construction of a main canal and rough land levelling of the cultivable waste lands. About 51 km of embankment along the Panlaung river were constructed to protect about 4,000 hectares of low lying lands from flooding. Another structure for by-passing flood water from the Panlaung river to the Pauk stream was also constructed. The areas with irrigation, drainage and flood protection facilities were expanded in three stages, reaching 34,952 hectares in 1985, 46,656 hectares in 1991, and 81,608 hectares in 1993. These irrigated areas have now been named into four townships: Myittha, Kyaukse, Wundwin and Tada U Township. The area of each township is 36,200, 8,400, 20,200 and 16,700 hectares, respectively.

(2.3.2) Irrigation Area and Agricultural Production

The actual irrigated area was showed in Table. 3. According to the Irrigation Department, originally the designed irrigable are was 81,500ha, however, from 1997 onward, it has been reduced to 70,506 ha

due to the expansion of Mandalay airport. It was also reported that in 1997 and 1998, the actual irrigated area was decreased due to the drought. In average it shows approximately 80% achievement of the target.

Table. 3 Irrigation Area

Unit:hectare

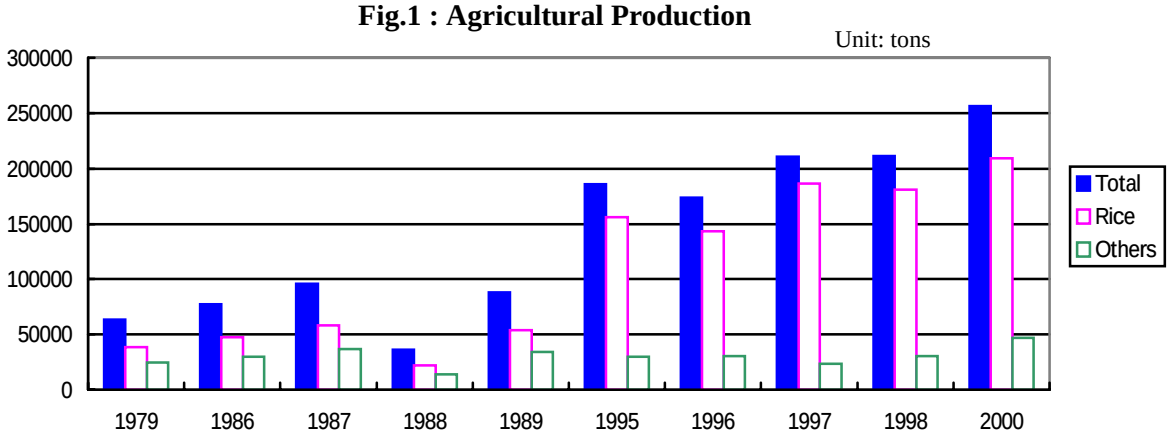
Year	Irrigable area	Rice	Cotton	Others	Winter Crop	Total
Before project	48,400	27,200	8,000			35,200
1992-93	81,500	28,042	6,249	28,630	4,032	66,953
1993-94	81,500	28,395	6,224	28,484	5,426	68,529
1994-95	81,500	30,423	6,370	29,673	4,904	71,370
1995-96	81,500	30,752	3,467	25,908	7,953	68,080
1996-97	81,500	28,348	7,818	31,487	5,425	73,078
1997-98	70,506	23,207	8,290	19,968	8,263	59,728
1998-99	70,506	23,619	6,646	24,410	5,968	60,643
Target	81,500	35,280	45,320			80,600

Source : Irrigation Department (ID)

On the other hand, as shown in Fig. 1, agricultural production volume shows the increasing trend. Actual production volume in 2000 was 256,000 tons, close to the target value of 287,000 tons at the time of appraisal.

With better rainfall in the catchment and the better access to fertilizer and agro-chemicals, the agricultural production volume anticipated at appraisal would be achieved at full development.

Fig.1 : Agricultural Production



Source

1) Data in 1979 : Information Appraisal
2) Data from 1986 to 1989 : Report prepared by JBIC
3) Data from 1995 to 1998 : Estimation based on Data prepared by MAS
4) Data in 2000 : Hearing from ID at Kinda at Post-Evaluation

Note: “Others” are other than rice such as onion, chillies, sesame and beans.

According to the Irrigation Department, the data of actual irrigated area and agricultural production cannot be simply compared because the former shows the irrigated area with inflow from the reservoir, while the latter includes the agricultural production of area irrigated by the ground water.

(2.3.3) Agriculture Support and Agriculture Mechanization

Strengthening of the Myanmar Agriculture Service (MAS) for Training and Visit extension system and trials for non-rice crops are promoted under the project. These activities include establishing a 4,500-hectare seed production and research farm within the new area, creating demonstration plots at selected places, building necessary facilities and hiring additional staff for training farmers.

Strengthening of the Agriculture Mechanization Department (AMD), by procuring additional machinery and materials and establishing agricultural machinery repair workshops, provides repair facilities for farmers.

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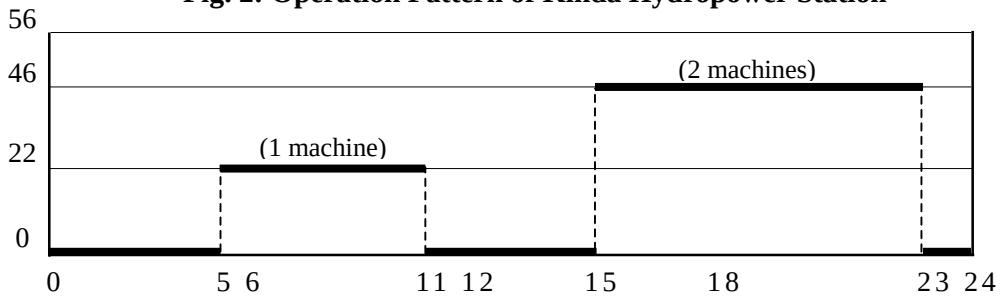
(2.3.4) Electric Power Generation

The design capacity of the hydropower station (28 MW x 2 Units) was confirmed in performance tests conducted in December 1985. The station commenced supplying energy to the National Power Grid in 1986. Yearly unit generation fluctuates between 31 to 222 GWh (target value = 165 GWh). This fluctuation of generation was caused by demand side requirements and was not due to the matters in the hydropower station.

The present function of the hydropower station has been peak shaving, and it is now operated under the standard operation pattern (utilization factor = 37.2%, equivalent to 173GWh generation) as illustrated in Fig.2.

Fig. 2: Operation Pattern of Kinda Hydropower Station



Source: Hearing from Kinda Hydro Power Station at the time of post-evaluation.

(2.3.5) Recalculation of Internal Rate of Return

According to an IDA report, Economic Internal Rate of Return (EIRR) was 21.3% at the appraisal and 14.1 % on the project completion in 1992. The lower EIRR at the time of the project completion is due to higher project cost. Recalculation of EIRR at present was not carried out due to the availability of data.

2.4 Impact

(2.4.1) Agricultural Production

At the time of appraisal in 1980, the production of rice and other crops in the related areas were 38,800 and 24,600 tons per year, respectively. In 2000, these figures reached 209,000 tons and 47,000 tons.

If amount of production after the project is compared with that before the project, production of rice increased 5.4 times, while other crops increased 1.9 times . The increase for all agricultural products was 4.0 times . This substantial increase in agricultural production can be attributed to the rehabilitation of existing irrigation systems, construction of new irrigation systems and provision of flood control facilities (followed by the construction of the multipurpose dam) implemented in this project.

(2.4.2) Flood

Before completion of the multipurpose dam, an area of 4,000 hectares was flooded every year. Since completion of the multipurpose dam, no flooding has been recorded.

(2.4.3) Impacts to Local Residents

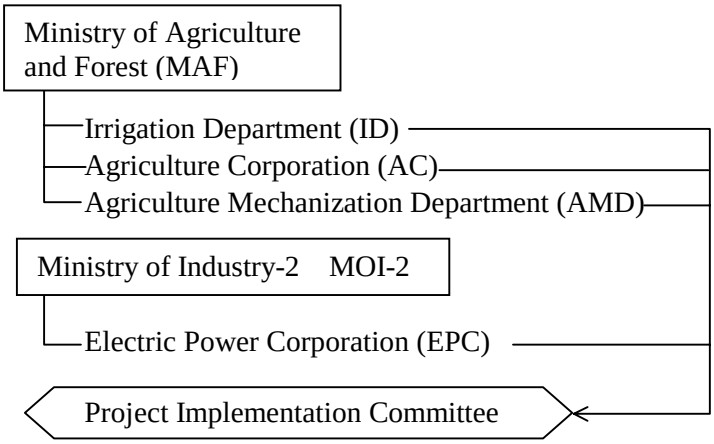
The resettlement of three villages of about 1,000 people displaced from the areas where the reservoirs were built was carried out. All of the families were settled together in the new irrigation area downstream of the dam. Their new houses were constructed as part of the project cost, and sufficient irrigated agricultural land was allocated to each family to strengthen family incomes.

2.5 Sustainability

(2.5.1) Operation and Maintenance

The project was implemented under the organization shown in Fig. 3.

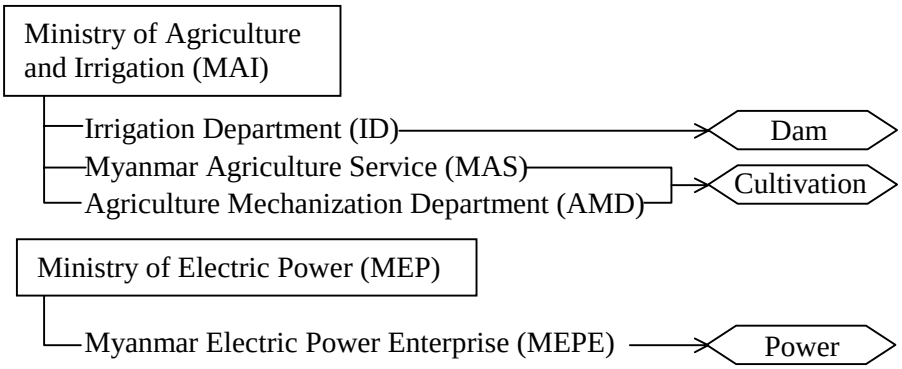
Fig. 3: Organization during Project Implementation (at the time of appraisal)



During project implementation, the organization, structure and names of the agencies concerned were all changed. The organization of the agencies in charge of operation and maintenance of the project at the time of post-evaluation is shown in Fig. 4.

- Multipurpose Dam and Irrigation/Drainage Facilities: Branch office of Irrigation Department at Kinda Dam with 260 staff
- Cultivation: Myanmar Agriculture Service (MAS) and Agriculture Mechanization Department (AMD). The main function of MAS is the development and transfer of appropriate agro-technology, multiplication of pure seeds, recommendation and provision of agriculture inputs, proper soil classification and exploration of exports.
- Hydropower Station: Myanmar Electric Power Enterprise (MEPE) at Kinda Dam Power Station with 96 staff

Fig. 4: Organization for Operation and Maintenance (at the time of post-evaluation)



Actual maintenance costs are shown in Table 4. The figures are considered reasonable for keeping the equipment and materials in proper working condition.

(Note: Data on the financial status of theO&M organizations concerned were not available at the time of post-evaluation.)

Table 4: Actual Maintenance Cost

Unit: Million Kyats

1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.58	1.46	2.12	2.20	5.52	9.65	5.20	5.69	13.64	39.35	7.84	26.34	30.73

In terms of human resources and O&M skills, the operations and maintenance capacity of above four organization is considered sufficient.

(2.5.2) Sustainability

The Government of Myanmar still places high priority on the agriculture and power sectors. In order to increase foreign currency earnings from the agricultural sector, which basically supports the national economy, concerted efforts are being made to increase the production of the four major crops: paddy, pulses, cotton, and sugarcane. This project is considered sustainable and can be expected to maintain its sustainability in the future.

Comparison of Original and Actual Scope

Item	Plan	Actual
① Project Scope		
(1) Multipurpose Dam	Dam Height: 72m Crest Length: 620m Active Storage Capacity: 765 million m^3	Dam Height: 72m Crest Length: 625m Active Storage Capacity: 871 million m^3
(2) Hydropower Station	28MW x 2 = 56MW	28MW x 2 = 56MW
(3) Irrigation and Drainage Facilities	Coverage Area: 80,000 ha	Coverage Area: 81,608 ha
(4) Agriculture Support	Machines for Agricultural Propagation	Machines for Agricultural Propagation
(5) Agriculture Mechanization	Machines for Farmland Preparation	Machines for Farmland Preparation
② Implementation Schedule		
(1) Dam & Hydropower Station	Dec. 1980 – Dec. 1985	Dec. 1980 – Dec. 1985
(2) Irrigation and Drainage Facilities	Jan. 1981 – Dec. 1985	Jan. 1981 – Jan. 1991
③ Project Cost		
Foreign Currency	158.0 Million US$	146.6 0Million US$
Local Currency	77.0 Million US$	112.43 Million US$
Total	235.0 Million US$	259.03 Million US$
ODA Loan Portion	3,600 Million Yen	3,081 Million Yen
Exchange Rate	240 Yen/US$	240 Yen/US$