

Key Issues:

12-Benefits due to Dam Function

- 11-Benefits due to Power Generation
- 14-Development of Regional Industries

Climatic Zone:

Am: Tropical Monsoon

Subjects:

- Ancillary Benefits to Local Communities derived from Dam and Reservoir



Effects:

- Lake Fishery Development
- Flood Protection by Dam
- Lift Irrigation Implementation
- Tourism Promotion

Project Name: Nam Ngum 1 hydropower plant

Country: Lao People's Democratic Republic (Asia)

Implementing Party & Period

-Project: Ministry of Industry and Handicrafts (MIH)
1984 (Operation commenced) -

- Good Practice: Ministry of Industry and Handicrafts (MIH)
1984 (Operation commenced) -

Key Words:

Lake Fishery, Flood control, Lift Irrigation, Tourism Promotion

Abstract:

Nam Ngum 1 hydropower project, the first hydropower project in Lao PDR, was implemented by the Mecon Commission as part of the national development plan. Though this project was originally implemented as a stand alone hydropower project, the dam and reservoir provided a great deal of ancillary benefits for local communities, such as flood protection, implementation of lift irrigation, lake fishery, and also tourism development.

1. Outline of the Project

Lao PDR's hydropower potential is one of the main resources of the country. The country has an estimated potential of some 18,000 MW from over 60 project sites on the tributaries of the Mekong River, of which less than 3 per cent has been developed. The Nam Ngum 1 Hydropower Project was the first such development.

The project is situated 60 kilometers north of Vientiane on the Nam Ngum tributary of the Mekong River (Figure 1). It is a gravity concrete dam with a power station at the base of the dam and with the penstocks in the actual dam. The dam was originally constructed with two 15 MW generators in 1971, to which two 40 MW generators were added in 1978 and a last 40 MW generator in 1984. The Specifications are given in Table 1, and the photograph is given in Photo. 1.

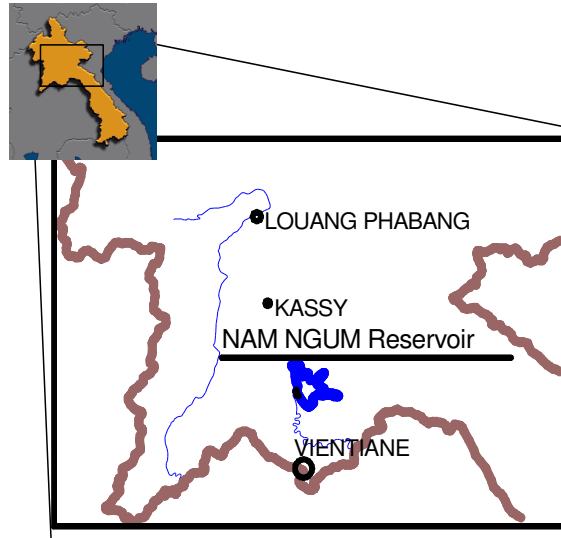


Figure 1: Location Map of Nam Ngum 1 Reservoir

Table 1: Specifications of Nam Ngum 1 Hydropower Project

Item		Specification
River system		Nam Ngum river, Mekong river system
Catchment area		8,460 km ²
Power station	Max. output	150MW, (2units x 15MW, 3units x 40MW)
	Head	48~30.8 m
Dam	Type	Concrete gravity
	Height	75 m
	Crest length	468 m
Reservoir	Area	400 km ²
	Gross storage capacity	7,030 x 10 ⁶ m ³
	Effective storage capacity	4,700 x 10 ⁶ m ³
	Available depth	16m (FSL 212m, MOL 196m)

(Sources: Department of Electricity, Ministry of Industry and Handicrafts, Lao P.D.R.)



Photo.1: Nam Ngum 1 Power Station

During the 1960s, power production in Lao PDR was not sufficient to comply with the national needs and had to be increased through local developments and power loans from Thailand. After discussion and planning through the 1950's a feasibility study presented in December 1962 detailed the purposes of the Nam Ngum 1 project, which were hydropower generation, flood control and irrigation. The project was implemented by the Mekong-Commission as part of the 1969-1974 Lao Development Plan. Although this plan was drawn up while Lao PDR was a constitutional monarchy (1954-1975), it was greatly affected by the political changes, which culminated in the establishment of a communist government in 1975. Construction of the dam was carried out between 1968 and 1971. The history of the project is summarized in Table 2.

Table 2: History of the Nam Ngum 1 Hydropower Project

Date	Event
1957	Start of planning, after formation of the “Committee for the Coordination of Investigations of the Lower Mekong Basin”
Aug 1964	Issue of “Feasibility Report on the Nam Ngum 1 Multipurpose Project, Laos”
1966	Establishment of the Nam Ngum 1 Fund to finance the first stage of the project (multinational, including Japanese funds administered by the International Bank for Reconstruction and Development, World Bank)
1968/69	Completion of Definite Design and start of construction of Stage I
1969	Attention to Fishery Development Begins (Pantalu Paper)
Dec 1971	Commission of Stage I, with a full supply level of 202.5 m asl, with two 15 MW turbine-generator units and intakes for units 3, 4 and 5 (Cost \$US 28 million, 1971 Dollar exchange rate)
1973	Issue of Feasibility Study for Stage II
Jul 1974	Establishment of Stage II Fund (multinational, including Japanese funds administered by the Asian Development Bank)
Jan 1976	Start of Phase II Construction and Supplement to Stage II Fund
Apr 1976	Supplement to Nam Ngum I Stage III Fund (Japanese and the ADB funds)
Oct 1978	Commissioning of Stage II. Installation of four spillway gates, raising the full supply level to 212 m asl and an addition of two 40 MW turbine-generator units (Cost \$US 49 million, 1978 Dollar exchange rate)
1979	Start of Project “Development and Management of Fisheries in the Nam Ngum 1 Reservoir”, funded by Netherlands Government (1979-1982)
1980	Issue of Feasibility Study for Phase III
Apr 1983	Start of Stage III extension work
Sep 1984	Commissioning of Stage III, adding a third 40 MW turbine-generator unit (Cost \$US 20 million, 1984 Dollar exchange rate)
1987	Start of Project “Development of Fisherman Communities in the Nam Ngum 1 Basin”, funded by Switzerland (1987-1989 and Phase II, 1989-1992)
1988	Start of Mekong Irrigation Program (MIP)
May 1992	Issue of Feasibility Study for the Nam Song Diversion Project
Dec 1995	Start of operation of the Nam Song Diversion Project, increasing reservoir inflows by about 25 per cent
1997	Start of Project “Development of Reservoir Fisheries in the Mekong Basin”, funded by Denmark

It might be said that the first development phase of the Nam Ngum 1 project has been completed in 1984 with the installation of the fifth generating unit. In the narrow sense, this marks the end of the original Nam Ngum 1 Project. Responsibility for operation of the project rests entirely with the national power utility Electricité du Laos (EdL), a state enterprise under the Ministry of Industry and Handicraft.

2. Features of the Project Area

The Nam Ngum River originates in Phou Kout in the northeastern part of the Tran Ninh Plateau, through which the river flows southwestward. At the foot of the steep mountains, on the southwestern edge of the plateau, the river turns south, and flows down to the Vientiane plain where it is joined by the Nam Lik River, about 60 km, north of Vientiane. Further to the east at the Tha Ngon bridge site, about 20 km north of Vientiane, the Nam Ngum River changes its course and discharges into Mekong River, at about 55 km east of the city. The total length of the Nam Ngum River is about 420 km (Figure 2).

The rainy season at the Nam Ngum 1 Basin is from May to October, when the southwestern monsoon with moist warm air from the Indian Ocean prevails over the basin. From November to April, the dry season predominates, because of the influence of the northeastern monsoon, which is dehydrated while passing over the Annan Cordillera.

Rainfall is concentrated in the rainy season, during which precipitation is about 84 to 94 per cent of the annual precipitation. The average precipitation in the Nam Ngum 1 Basin area was estimated at about 2,000 mm per annum and the annual run-off at about 18 billion m³ or about 570 m³/s on an average.

The monthly temperature tends to rise to its highest degree in April or May, coming down gently in the rainy season and falling to the lowest in December or January. The annual mean temperature in Vientiane is 25.8 degrees, the maximum monthly mean temperature is 28.4 degrees in April, and the minimum is 21.3 degrees in January.

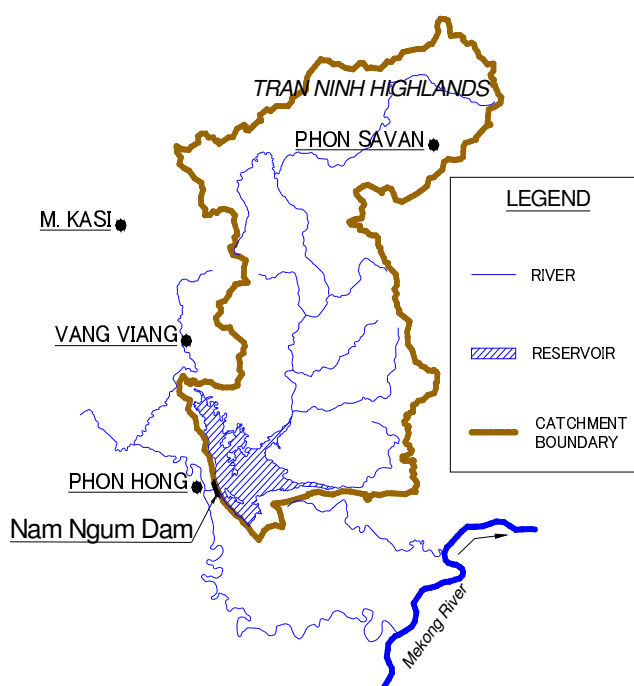


Figure 2: Nam Ngum River system

3. Benefits

3.1 Fishery

The importance of the fishery as a source of income for a large number of local people was not anticipated by the completion of Nam Ngum project. Fishery development projects contributed by Netherlands and Switzerland after completion of Stage-II in 1978, shown in Table 2, facilitated employment to the fishery in Nam Ngum 1 reservoir. These projects included construction of primary schools and water supply networks and provision of monofil gill nets and boat engines to selected villages.

Nam Ngum Reservoir Management and Development Organization (NMDO) manages lake fishery.



Photo. 2: Pa Sakang, most typical fish

According to NMDO, the annual fishery production from Nam Ngum 1 reservoir is about 6,000 ton. They can list 68 kinds of economic fishes within almost 120 kinds in the reservoir. The most typical fish, *Pa Sakang* (*Puntionplites Falcifer*), is shown in Photo. 2.

3.2 Flood control

While the main object of Nam Ngum 1 project was electric power generation, Nam Ngum 1 reservoir has been also used for minimizing flood impact.

From August to September every year, the flood storage capacity to meet large flood flow into Nam Ngum 1 reservoir, 1.0 billion m³, is prepared. And, operation rules depending on the flood scale were established.

3.3 Irrigation

The Nam Ngum 1 Project was implemented as a stand-alone hydropower Project. However, through activities of the foreign supporting parties, the dam and reservoir provide irrigation benefits in the Vientiane Plain through lift irrigation using electricity from the hydropower plant. Table 3 shows the information of electricity pump stations and the extents of irrigated area.

Table 3: Pump stations for irrigation

Districts	Pump station			Whole irrigated area ^{*2} (ha)
	Quantity (Nos.)	Area (ha) by season ^{*1}		
		Rainy	Dry	
1.Phohong	13	3,530	467	5,925
2.KeoOudom	10	1,935	1,008	2,351
3.Vienkham	20	1,229	1,024	1,429
4.Thoulakhom	12	2,430	1,535	3,508
Total	55	9,124	4,034	13,213

*1 Total irrigated area

*2 Irrigated area expanded by pump stations

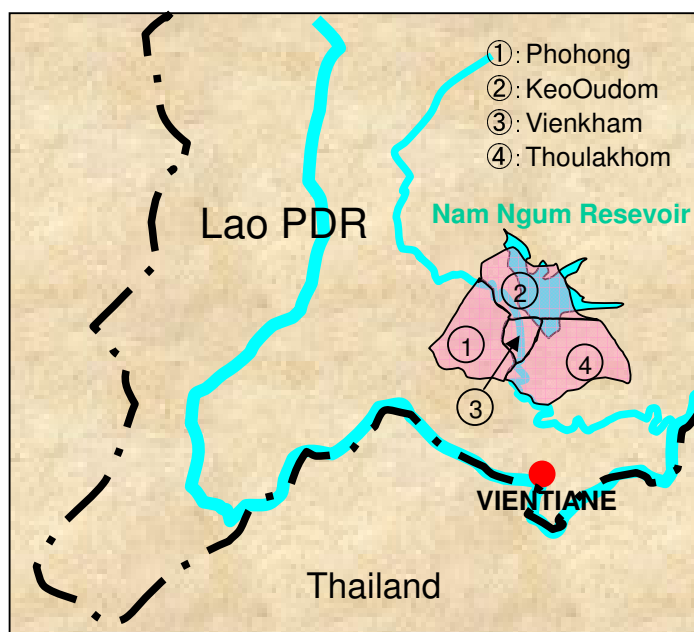


Figure 3: Districts irrigated by the electrical pump

3.4 Tourism

The Nam Ngum 1 reservoir has been regarded as an important tourism resource recently. Lao government approved the development of "Dan Sa Vanh - Nam Ngum resort" to Malaysian company. This resort is located at the southeast of Nam Ngum reservoir and approximately 60km from Vientiane. It features a hotel, restaurant, game arcade, golf course and others. Moreover, the company is planning to expand and improve the facilities.

4. Effects of the Benefits

4.1 Fishery

The opportunity created by the fishery was apparently seen by the local population. By 1981, the settlements along the banks of Nam Ngum 1 reservoir had a population of 9,561 persons living in 1,652 households, in 31 villages. The percentage of fisherman in the economically active population had risen from 2 per cent in 1974 to 39 per cent in 1981, while 48 per cent of fisherman indicated that they had been farmers before they had started to fish in the reservoir.

They have continued to attract immigrants to the shores of the Nam Ngum 1 reservoir. In 1991, the Burapha survey recorded that the number of villages on the lakeshore had increased to 40, with 2,498 households and a total population of some 15,700 inhabitants. Of these households, 92.5 per cent were engaged in fishing activities, although only 20.2 per cent claimed this as their main occupation. Others saw fishing as a secondary occupation to agriculture.

And now, according to MIH, it comprises 2,500 families and 16,800 people, besides 8 organizations' workers including business, development and government organization.



Photo. 3: Fish market near Vientiane

4.2 Flood control

No assessment of actual benefits was carried out yet. However, we can see an illustration of the impact in the village of Ban Tan Piou. Ban Tan Piou was notoriously subject to flood before the construction of the Nam Ngum 1 dam. Villagers claimed that there was flood every year. Today floods still affect one third of the 700 ha of riceland in the village, but the damage of floods have been reduced.

There is no information of loss of life, but it is possible to suppose that many lives receive positive effects from this issue.

4.3 Irrigation

The areas for rice production around Vientiane Municipality and Vientiane Province amounted to 46, 237 ha and 35, 268 ha respectively in 1998. For the same year, irrigated rice accounted for 12,597 ha and 3,750 ha, about 25 per cent of the irrigated rice area in the whole country.

Rice productions from the Vientiane Municipality and the Vientiane Province in 1998 were 147,530 tons and 53,035 tons. Interestingly, the yields in the area are highest in the country. This can probably be attributed to, among other things, the availability of irrigation, which is in turn dependent on electric power pumping. According to MIH, the harvest in the irrigated area is about 4.7 ton /ha.

Photo 4 shows an irrigated rice field in dry season.



Photo. 4: Irrigated rice field at Thalath village

4.4 Tourism

According to Lao's statistic 2002, tourists who visited Nam Ngum reservoir were about 21,000 people, and 70% of them were foreigners. And they spent about 630,000USD or 5,266,800,000kips, especially in "Dan Sa Vanh - Nam Ngum resort". And the government estimates the future income at about 5,000,000USD with 100,000 tourists after the completion of the expansion plan.

5. Reasons for Success

- 1) Appearance of the man-made lake
 - It made a new opportunity of fishery.
 - The storage capacity of the lake is large enough to reduce the damage of floods.
- 2) Provision of the electricity from the Nam Ngum 1 hydropower plant
 - Nam Ngum 1 project promotes the electrification on Vientiane plains and the adjacent area. Consequently, the lift irrigation system with the electrical pump became possible.
- 3) Activities of the foreign supporting parties
 - The Mekong River Commission and the other parties made several supporting programs.

6. Outside Comments

<A Head of Thalath agricultural irrigation system, in Ban Phone yeng (18/2/2003)>

"Thalath agricultural irrigation system was commissioned in 1986 by Australian support project. Since then, it is possible to raise two crops a year, before that, we could make only wet season cropping.

7. Further Information

7.1 References

- 1) ADB RETA5828, Study of large dams and recommended practices, Annex1 NAM NGUM 1 case study report, Lao PDR, April. 2001.
- 2) Dansavanh Nam Ngum Resort HP: <http://www.dansavanh.com>

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