SAMBOR PROJECT REPORT

a Further Report for the Information
of the Advisory Board of the Mekong Committee

December 1969

Overseas Technical Cooperation Agency

Tokyo, Japan

Mr. Kanwar Sain
Ditector of the Engineering Services
Mekong Committee
ECAFE
Bangkok, Thailand

Dear Mr. Sain,

Subject: Further Report of Sambor Project

I have the pleasure to inform you that this Further Report, prepared for the information of the Advisory Board, contains the comment of the Sambor Team in the following two parts, one relating to the observations of the Advisory Board made at its 12 th Meeting on the Sambor Project Final Report and the other concerning the views of Mr. Hayath on the same subject.

Part I: Comments on Item 5 - Sambor Project Report: Final Report, 1969, Page 12 – 14, 12 th Meeting of the Advisory Board of the Mekong Committee, 1 – 13 Sep. 1969, Bangkok, Thailand (see Appendix I)

Part II: Comments on the views of Mr. Hayath, TEC 322 (3 – 2) Eq., 25 Sep. 1969 (see Appendix II)

Yours sincerely,

Koichi Aki
Adviser
OTCA
Tokyo, Japan

Part I : Comments on Item 5 - Sambor Project Report, 12 th Meeting of the Advisory Board of the Mekong Committee

As regards economic feasibility:

1) Comparison with thermal power in the isolated case of Sambor Project:

The comments on the rate of return given in page 12 is not appropriate. According to our estimations, and also as shown in the Sambor Project Report, Volume I, MAIN FEATURES OF THE PROJECT, A.4 Power Transmission Facilities, the internal rate of return in the isolated case, where power is assumed to be consumed by general demand only, is 5.3%. This analysis covering a period of 50 years is based on the assumption that the output of Sambor will be gradually consumed by general demand over a number of years. But, if the power cost of the Sambor Project is estimated at a point when all of its output is consumed by general demand and an interest rate of 6% p.a. is applied, the energy cost would be around 8.0 mills per kWh, which is slightly less than the estimated cost of thermal power (9.0 mills).

It is not appropriate to evaluate the feasibility of the Sambor Power by comparison with an alternative thermal power plant only. The Project is not to supply general demand only, but it can also supply energy for aluminum smelter and some chemical industries.

The point is that, although the Sambor Project in the isolated case, as already mentioned in the Report, is not necessarily highly attractive, the technical and economic feasibility is fairly good and above all its contribution to the socio-economic development of the region should not be overlooked. Also, there is the great benefit of saving of foreign exchange requirement for importation of fuel for thermal power.

As regards technical features:

a) The difference between high water level and crest elevation:

More detailed calculations have been undertaken using a hydrograph which has a peak discharge of 90,000 cu.ms., taking into consideration surcharge effect as shown on the attached figure. This flood hydrograph is estimated on the basis of the 1966 flood (recorded maximum flood).

According to our calculations, the maximum water surface elevation will rise to 41.2m. On the other hand, the wave height is 2.0m to 2.5m assuming the wind velocity of 20m per second for 10 minutes and the fetch of 30 to 50 km. Adding this value to the maximum water surface elevation, the ultimate water surface elevation becomes 43.2m to 43.7m which is below the dam crest elevation 44.0m. Furthermore, the maximum flood discharge of 90,000 cu.ms is considered to be a flood of a frequency of once in 10,000 years, and it will be possible to draw down the reservoir level in advance by establishing good communication system with the upstream gauging stations. From these considerations above, the dam crest elevation of 44.0m is considered appropriate.

b) Possible erosion in river bank:

The purpose of the hydraulic model test for the Sambor Spillway was to examine the general flow conditions after the dam is completed. The model test could not verify whether bank erosion at the opposite side could happen or not. But if this possibility is confirmed in the definite study in future, it will be necessary to change the flow direction at the end of the spillway-chute by means of deflectors or something to protect the opposite bank. The cost for these additional facilities will be minor compared to the total construction cost and could be covered by the contigencies.

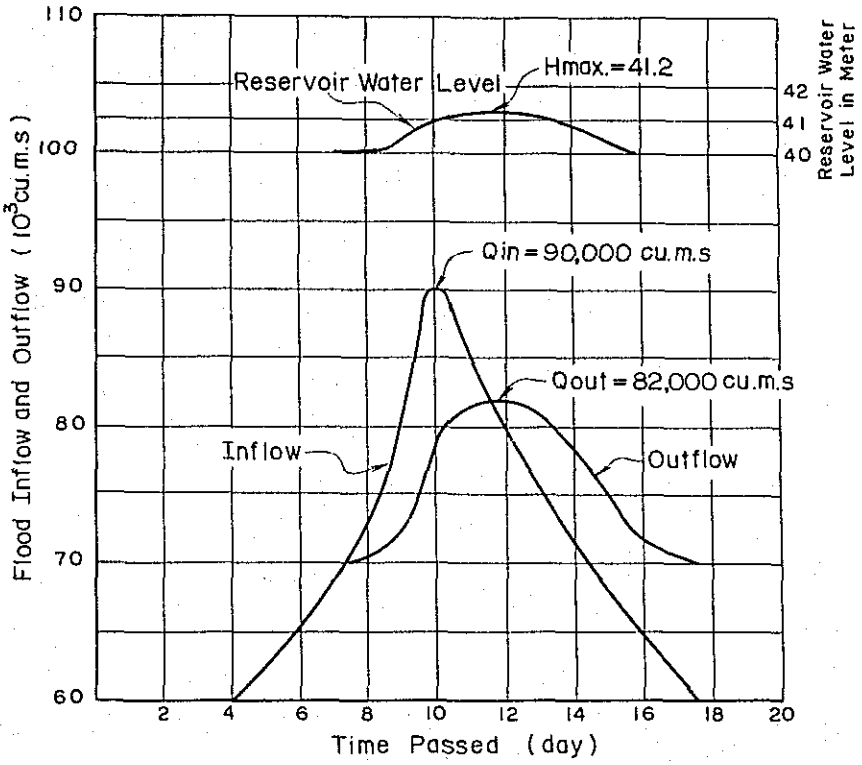
c) Possibility of establishing aluminum industries:

A Japanese Survey Mission, composed of several specialists from Japanese aluminum industries, visited the project area in November 1969 to study the possibility of establishing an aluminum industries. The Mission is now preparing the report.

d) Possibility of Viet-Nam accepting Sambor power at 9 mills per kWh:

This problem is closely related to the availability of alternative power sources in Viet-Nam in case power from Sambor can not be supplied, and should be investigated further by the Mekong Committee. As described in the Sambor Project Report, Volume I, D-1-1-5, the Sambor Project is to supply 60% of the increment of general demand in Viet-Nam in and after 1978 and not 100% of the increment. So, it will be necessary to construct hydro or thermal power plants to supply the remaining 40% of load increment. In the early stage, it may be possible to supply the load increment with low cost hydro power, but as time passes and economic hydro resources are developed, conventional thermal plants will have to be built to satisfy the demand. The power rate of 9 mills of Sambor power for general demand will be equal to the power rate of this conventional thermal power. And it is believed that this power rate is reasonable in view of the fact of the higher prevailing power rate in Viet-Nam. Furthermore, it must not be overlooked that Viet-Nam can save large capital expenditures for the additional capacity installation, if they will receive the Sambor power.

Flood Inflow and Outflow



by Cheng Method

Part II : Comments on the views of Mr. Hayath

As described in the Sambor Project Report, Volume II, D-2-1, the optimum installed capacity of the Sambor Project (2,100MW) with Pa Mong and Nam Ngum Project was determined on the basis of obtaining the cheapest firm energy in combination with thermal power. Secondary energy from this optimum installed capacity is something like a by-product. In this aspect, it appears that there is a misunderstanding in the Mekong Committee in the assumption that the dependable peak output of 1,390MW is generated by 8 units. This output is the possible lowest peak output in wet season during the year from 1951 to 1965 operating 12 units as being shown in D-3 of the Report.

But from a different point of view, it might be possible to evaluate the secondary energy as stated by Mr. Hayath. Our project study is based on the conception that the huge amount of this secondary energy should be consumed by chemical industries to improve the project economy. The unit cost of this secondary energy (2.0 mills per kWh) is considered to be the lowest possible price for this purpose in consideration of the unit cost of firm energy (2.5 mills per kWh) for aluminum refining industries.

Appendices

I. From the Report of the 12 th Meeting of the Advisory Board of the Mekong Committee

II. Views of Mr. Hayath

Appendix I:

From the Report of the 12th Meeting of the Advisory Board of the Mekong Committee

ITEM 5 - Sambor Project: Final Report, 1969

Dr. K. Aki, Leader of the Sambor team, introduced the project on behalf of the four representatives attending the discussion and on behalf of OTCA. The technical and economic aspects of the Sambor project in both isolated case as well as working after the Pa Mong and Nam Ngum releases become available were closely examined. With a draw-down of 2 meters, the effective storage capacity of the reservoir is only 2,050 million cubic meters. The installed capacity in the isolated case is proposed to be 875 MW, but the firm power output only 473MW. This increases to 1,120MW firm output with 2,100MW installed cpacity when Pa Mong and Nam Ngum releases become available. The area proposed to be brought under irrigation is 34,000 hectares in the isolated case. On additional releases from Pa Mong and Nam Ngum being available, the area to be irrigated is proposed to be increased to 580,000 hectares downstream of the project site. For navigation, three inclined passage facilities are included.

As regards economic feasibility, the Board has the following observations:-

1) In the isolated case, the internal rate of return is shown to be 4.4 per cent. On page G-2, Volume I - General Report, the Japanese team has shown that the cost of alternative power source - conventional thermal plant having two 125MW oil burning units operating at an average thermal efficiency of 36.5% and a load factor of 60% - is 9 mills per kWh taking 6% interest rate. It is, therefore, obvious that thermal power can be produced cheaper than hydro power from isolated Sambor Project.

2) In the second case, after the Pa Mong and Nam Ngum releases are available, the internal rate of return is shown higher than 6%. Under such conditions, the Sambor project becomes economically feasible, provided the power that will become available can be consumed in accordance with the load curve assumed in the project, and that the following technical observations do not change costs very much.

As regards technical features the following observations were made:-

a) The difference in elevation between the maximum high water level and the crest of dam and earthfill dikes is only 2 meters. Taking into consideration the great length of the reservoir, there is a risk that the combined action of wind, waves and cyclonic depression may cause some water to pass over the dikes, and possibly erode and destroy them, which would release ten billion cubic meters of water, all over the Mekong valley. The Board did not have in hand enough data to calculate what should be a safe free board but noted that, in the case of Nam Mong, an earthfill dam annexed to Pa Mong with much smaller fetch, the difference between high water level and crest elevation is three meters, which suggested that the difference should be increased at Sambor due to larger size of reservoir.

b) According to the hydraulic model tests, it appears that, due to the location and direction of the spillway, the flow at high water will strike the left bank diagonally at a velocity of 3 m/s against 2 m/s parallel to the bank in its natural state. This will cause heavy erosion on several kilometers down the river, wash out arable land supposed to be irrigated and make unstable the navigation channel.

In the meantime, the Board suggests that the following steps should be taken to ensure that the power consumption will be in accordance with the assumption made:-

Firstly, the Mekong Committee should follow up the possibility of establishing an aluminum smelter plant as well as other electro-chemical industry suggested in the report;

Secondly, the possibility of Viet-Nam accepting Sambor power at 9 mills per kWh should be further investigated.

Appendix II:

Views of Mr. Hayath

Mr. Kanwar Sain, Director
Engineering Services Division

25 September 1969

TEC 322 (3-2) Eq.

M. Hayath
Power & Industry Advisor

Sambor Project

The Advisory Board during the discussion of the Sambor project report indicated that a study should be made whether the incremental cost involved in installation of additional generating units to meet the demand of chemical industries which will be consuming secondary energy from Sambor project is economically justifiable.

As the Sambor project is not economically justifiable as an isolated project the following study has been based on the Sambor project report taking into consideration releases from Pa Mong and Nam Ngum. The feasibility report prepared by OTCA contains the following information:

Installed capacity	2,100 MW
Total energy potential	14.6 GWH
Firm energy	9.78 GWH
Capacital energy	4.82 GWH
Dependable peak capacity	1,390 MW
Continuous potential	1,120 MW
Capital cost total	$ 419.5 million
Dam	$ 99.7 million
Power plant (civil engineering work)	$ 115.3 million
Electrical equipment	$ 122.1 million
Transmission lines and substation	$ 62.4 million
Miscellaneous	$ 20.0 million
Total	$ 419.5 million

Eight generating units of 175MW each are adequate to utilise the firm potential and the maximum peaking capacity of the Sambor project. The total amount of generating units suggested for installation are 12 of 175MW each thus the four additional generating units are intended for meeting the demand of chemical industries consuming secondary power.

Some difficulty is experienced in determining the cost of installation of four additional generating units due to the fact that the civil engineering works included under the power plant cover the cost of dam and power station which is a combined structure. If four additional generating units are not installed, expenditure will have to be incurred to cover that gap in the dam by a concrete structure. The feasibility report provides rather meagre information and does not lend itself to determine accurately as

to what the cost of alternative structure of concrete dam would be in case the four additional units required for generating secondary energy are not installed. Therefore, the following allocation has been made in the cost of the civil engineering works for power plant which is dam and power house combined:

Cost of the dam	$ 45.3 million
Cost of power house	$ 70.0 million
Total cost	$ 115.3 million

If the above allocations are considered reasonable the following picture emerges:

Total cost involved in providing four additional generating units and additional transmission circuit for meeting the demand of secondary energy consumers is assessed as follows:-

1) Cost of power house for four units	$ 22.0 million
2) Cost of electrical equipment for four generating units	$ 49.0 million
3) Cost of transmission line and substation	$ 4.0 million
Total	$ 66.0 million

Against the above outlay the revenue from the secondary energy consuming industries is estimated at $7 million. Therefore the gross return on investment is over 10 per cent. It is felt that this additional outlay is justifiable.

It is understood that the installation of additional generating units for meeting the demand of secondary energy consuming industries will follow the assured demand to be realised.

Further it is to be mentioned the secondary energy will be firmed up when Sambor is electrically interconnected with Pa Mong.